10036

Diagram No. LS-9

NOAA FORM 76-35A

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY

DESCRIPTIVE REPORT

Type of Survey ... Hydrographic

Field No. ... PE-50-1-82

Office No. ... H-10036

LOCALITY

State ... Minnesota--Wisconsin

General Locality ... Lake Superior

Locality ... Offshore--Between Sand Island and Stony Point

1982

CHIEF OF PARTY
CDR W.S.Simmons

LIBRARY & ARCHIVES

DATE ... March 11, 1985

☆U.S. GOV. PRINTING OFFICE: 1980—766-230

10036

Area H

OHTS
14966
5960
10361

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NOAA FORM 77-28 (7-72)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REGISTER NO.

H-10036

HYDROGRAPHIC TITLE SHEET

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO.

PE 50-1 82

State MINNESOTA - WISCONSIN

General locality LAKE SUPERIOR

Locality OFFSHORE BETWEEN ~~STONY POINT TO CASTLE DANGER~~ SAND ISLAND AND STONY POINT

Scale 1:50,000 Date of survey 2 AUG 1982 to 15 OCT 1982

Instructions dated 31 MARCH 1982 Project No. ORP-Z137-PE-82

Vessel NOAA SHIP PEIRCE (2830), LAUNCH 1009 (2839), LAUNCH 1017 (2837)

Chief of party CDR WALTER S. SIMMONS

Surveyed by P. M. CONRICODE, M. R. MANDZI, G. N. MILLET, B. R. HARRIS, I. S. ANDREEVA

Soundings taken by echo sounder, ~~XXXX XXXXXXX~~ ROSS MODEL 5,000, RAYTHEON ~~DE-7230~~ Universal Graphic Recorder

Graphic record scaled by MPC, RMM, NGM, RBH, SIA, IPR, WRM, TO, EK

Graphic record checked by MPC, GEL

Protracted by _____ Automated plot by HYDROPLOT
SmoothSheet by XYNETICS 1201 Plotter (AMC)

Verification by D.V. Mason

Soundings in ~~XXXXXX~~ feet at ~~MLW~~ ~~MLLW~~ I.G.L.D. 1955 (Lake Superior: 600.0 ft)

REMARKS: (1) All times recorded in this survey are Coordinated Universal Time.

(2) Water level reducers are not applied to soundings.

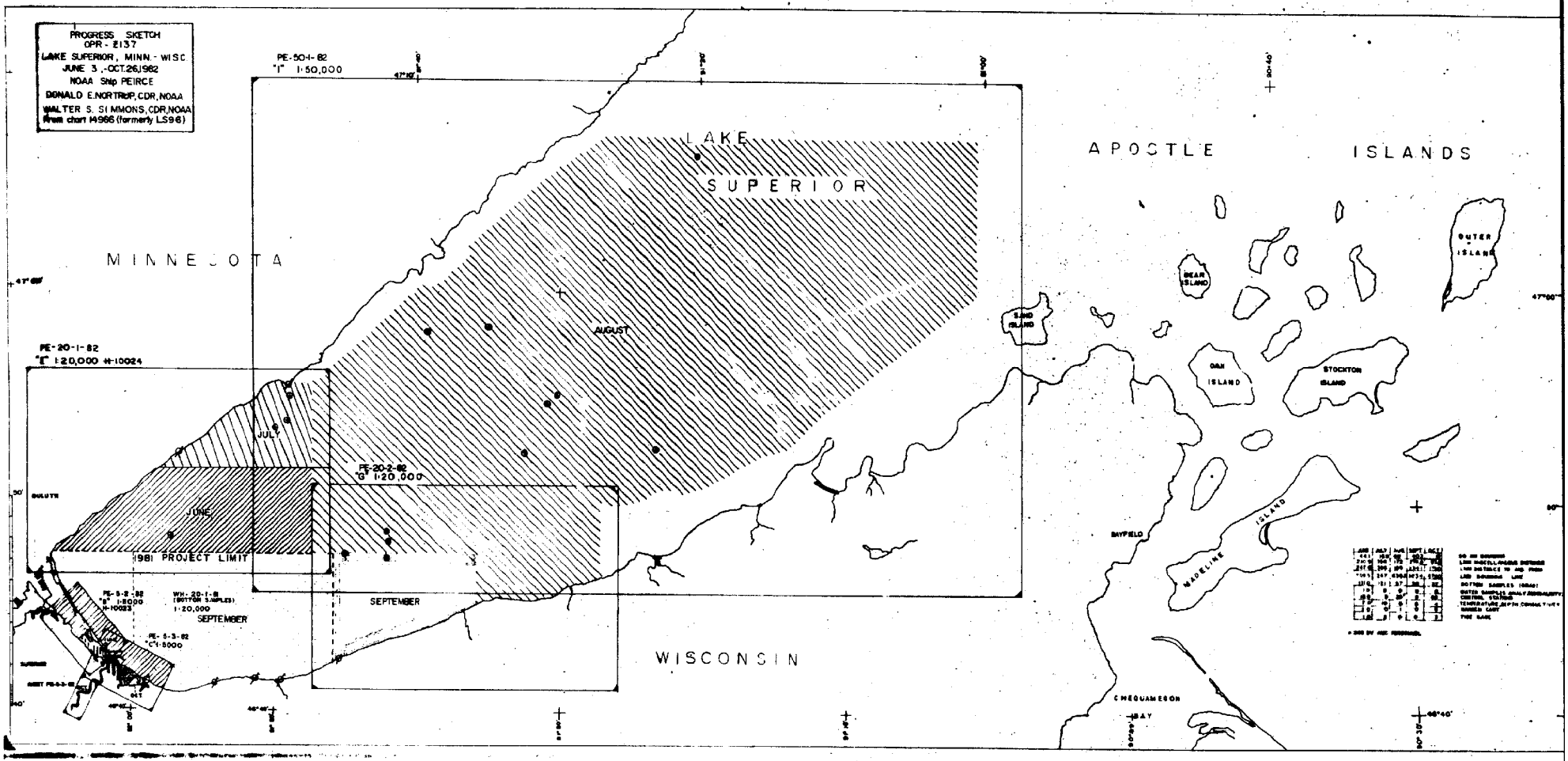
Notes in the Descriptive Report were made in red during office processing.

AWOIS checked 4/9/85 SJV

SURF checked 4/9/85 SJV

NOAA FORM 77-28 SUPERSEDES FORM C&GS-537.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1976—665-661/1222 REGION NO. 6


PROGRESS SKETCH
OPR - E137
LAKE SUPERIOR, MINN - WISC.
JUNE 3, -OCT. 26, 1982
NOAA Ship PEIRCE
DONALD E. NORTROP, CDR, NOAA
WALTER S. SIMMONS, CDR, NOAA
(from chart 14966 (formerly LS96)
PE-504-82
"I" 1:50,000
LAKE
SUPERIOR
MINNESOTA
WISCONSIN
APOSTLE
ISLANDS
AUGUST
JULY
JUNE
SEPTEMBER
SEPTEMBER
PE-20-1-82
"E" 1:20,000 H-10024
PE-20-2-82
"G" 1:20,000
1981 PROJECT LIMIT
PE-5-2-82
"B" 1:5000
H-10023
PE-5-3-82
"C" 1:5000
WH-20-1-82
(BOTTOM SAMPLES)
1:20,000
BEAR ISLAND
SAND ISLAND
OAK ISLAND
STOCKTON ISLAND
OUTER ISLAND
MADELINE ISLAND
BAYFIELD
CHEQUAMEGON BAY

DESCRIPTIVE REPORT

TO ACCOMPANY

HYDROGRAPHIC SURVEY H-10036 (PE-50-1-82)

1:50,000 SCALE, 1982

NOAA SHIP PEIRCE

CDR WALTER S. SIMMONS, COMDG

A. PROJECT

This survey was conducted in accordance with Project Instructions OPR-Z137-PE-82 dated March 31, 1982, from Associate Director, Marine Surveys and Maps, forwarded via Director, Atlantic Marine Center. There were two changes dated April 21, 1982 and June 16, 1982.

B. AREA SURVEYED

The offshore survey area extended from ~~Stony Point to Castle Danger~~ Sand Island to Stony Point in western Lake Superior. The area was bounded by the following limits:

LATITUDE	LONGITUDE
46°47'30" N	091°48'20" W
46°55'00" N	091°48'20" W
~~46°59'37" N~~ 47° 07' 36"	091°26'20" W ΦΦ"
~~46°59'37" N~~ 47° 07' 36"	091°01'37" W ΦΦ' 36"
47°07'18" N 46° 47' 36" N	091°01'37" W ΦΦ' 36" 091° 36' ΦΦ" W

This survey was conducted between August 2, 1982 (JD 214) and October 15, 1982 (JD 288).

C. SOUNDING VESSELS

The hydrographic survey was conducted by NOAA Ship PEIRCE, VESNO 2830 and two Type I Jensen Survey Launches. The Launches were 1009, VESNO 2839 and 1017, VESNO 2837. All of these vessels were equipped with the ~~hydroplot~~ HYDROPLOT/HYDROLOG system.

D. SOUNDING EQUIPMENT AND CORRECTIONS TO ECHO SOUNDINGS

Sounding equipment utilized during this survey is summarized in the following table:

JD	VESSEL	INSTRUMENT	S/N
All Days	PEIRCE (2830)	ROSS 5000	1078
All Days	PEIRCE (2830)	RAYTHEON PTR	162
266, 285-288	PEIRCE (2830)	RAYTHEON UGR 196C-23	164
230	LAUNCH 1017 (2837)	ROSS 5000	1087
231	LAUNCH 1009 (2839)	ROSS 5000	1079

During charted sounding investigations, Julian Days 266,285-288, both the Ross and Raytheon echo sounders were used to obtain near 100 percent bottom coverage. A teletype message and a letter from the Director, AMC, requiring the use of both sounding systems and the procedures to be followed has been included in Appendix J.

Velocity correctors were derived from XBT casts taken on JDs 228, 233, 235, 266, 286, 287 and 288. Corrections from days 228, 233 and 235 were meaned to obtain final correctors for JD 224 through JD 238. Velocity tables after JD 238 were made for each XBT cast. See section 4 of the Evaluation Report.

The velocity correctors were determined using an XBT model MK 2A-1 371, S/N 781209 TD which was tested on November 30, 1981. These results were compared to three Martek STD Casts, Model 167-10, S/N 177, which was tested in February 1982 and a Nansen Cast which was taken on August 23, 1982, JD 235, at 47°06'42" N, 91°20'19" W. See section 4 of the Evaluation Report.

The following table summarizes the dates and location of each station taken on this survey:

DATE (JD)	STATION	LATITUDE	LONGITUDE
16 Aug 1982 (228)	XBT #2	46°55'18" N	91°45'42" W
18 Aug 1982 (230)	MARTEK #18	46°49'00" N	91°31'00" W
21 Aug 1982 (233)	XBT #3	47°59'00" N	91°34'00" W - outside survey area.
23 Aug 1982 (235)	XBT #4	47°06'42" N	91°20'19" W
23 Aug 1982 (235)	MARTEK #19	47°06'42" N	91°20'19" W
26 Aug 1982 (238)	MARTEK #20	46°49'24" N	91°30'12" W
23 Sept 1982 (266)	XBT #9	46°58'12" N	91°35'00" W
13 Oct 1982 (286)	XBT #12	46°58'06" N	91°39'18" W

14 Oct 1982 (287)	XBT #13	46°52'30" N	91°23'12" W
15 Oct 1982 (288)	XBT #14	46°52'25" N	91°32'30" W

All data from JD 214 were rejected because no velocity determinations were available. This data was not rejected on the fathogram or on the printout, or the sounding ~~corrector~~ corrector abstract. Velocity table 31 was used for corrector to the sounding data.

Phase checks of the Ross echo sounders were done on a regular basis during the survey, usually at the end of each line. No other calibraton adjustments were made. The initial pulses for all echo sounders were set at zero. The draft corrections applied on-line were 10.6 feet for ship hydrography and 1.6 feet for launch hydrography. Bar checks were taken at the beginning and end of each day of launch hydro.

Settlement and squat tests for the ship were run on August 24, 1982. These tests were conducted at the Two Harbors breakwater using the Zeiss Level Instrument, S/N 18946 and the Philadelphia Rod positioned over the ship's transducer. Draft and settlement and squat test can be found in Appendix D. The corrections are as follows:

Throttle Setting	Correction
0	0.0
1	0.0
2	0.0
3	0.2
4	0.2
5	0.4
6	0.6
7	0.8
8	0.8

Settlement and squat corrections were determined for both launches on July 2, 1982. The tests were conducted from the northwest bulkhead along the northern section of Duluth Harbor Basin, Duluth, Minnesota. All readings were obtained using the Zeiss Level Instrument, S/N 18946 and the Philadelphia Rod positioned over each vessel's transducer. The results are as follows:

LAUNCH 1017		LAUNCH 1009	
RPM'S	CORRECTION	RPM'S	CORRECTION
0-2175	0.0	0-1300	0.0
2175-2350	-0.2	1300-1725	0.2
2350-2475	-0.4	1725-2150	0.0
2475-2650	-0.6	2150-2400	-0.2
		2400-2500	-0.4

Squat and Settlement correctors have not been used in the final field plot.

No unusual or unique methods or instruments were used for this survey.

The abstract of corrections to echo soundings, the printout for velocity, draft determination report, settlement and squat report and TC/TI tables can be found in Appendix D.

E. HYDROGRAPHIC SHEETS ✓

The field sheets were plotted onboard PEIRCE by the ship's PDP 8/E computer, complot roll-bed plotter, and program RK211.

Hydrographic data are presented on seven sheets. The mainscheme is depicted on three sheets, East, Middle and West. Each of these sheets has an overlay sheet that depicts crosslines, mainscheme splits and bottom samples. These sheets are at the scale of 1:50,000 with a skew of 90, 21, 45. The seventh sheet is a 115 foot shoal development at a scale of 1:10,000 with a skew of 90, 21.5, 22. A listing of the sheet parameters is in Appendix A. The final smooth sheet will be compiled at the Atlantic Marine Center, (AMC). All Field records will be forwarded to AMC for final verification.

F. CONTROL STATIONS

See section 4 of the Evaluation Report

The following stations were used to control this survey:

SIGNAL #	STATION NAME	SOURCE	USE
102	WICK, 1981	AMC	ARGO STATION
103	TWO HARBORS LIGHTHOUSE, 1952	NGS	VISUAL CALIBRATION
104	PICNIC AZ MK, 1981	AMC	VISUAL CALIBRATION
105	PICNIC, 1981	AMC	VISUAL CALIBRATION
106	LAKEWOOD, 1981	AMC	VISUAL CALIBRATION
107	TALMADGE 1952	NGS	VISUAL CALIBRATION
108	BUCHANAN 1952	NGS	VISUAL CALIBRATION
109	TWO HARBOR RADIO MAST, 1977	NGS	VISUAL CALIBRATION
110	FLOOD, 1981	AMC	VISUAL CALIBRATION
112	BACHMAN MNDT 1977	NGS	VISUAL CALIBRATION

113	ANDERSON RM1, 1981	AMC	ARGO STATION
114	MN PT ARGO, 1980	AMC	ARGO STATION
122	SPIT, 1981	WH	VISUAL CALIBRATION
123	CABIN SIGNAL, 1981	WH	VISUAL CALIBRATION
124	MIDDLE RIVER SIGNAL, 1981	WH	VISUAL CALIBRATION
125	EROSION, 1981	AMC	VISUAL CALIBRATION
126	ORIENTA, 1981	AMC	VISUAL CALIBRATION
127	ANDERSON RM 2, 1981	AMC	VISUAL CALIBRATION
128	QUARRY INN, 1981	AMC	VISUAL CALIBRATION
002	DULUTH ENGER MEMORAL TOWER, 1952	NGS	VISUAL CALIBRATION
044	DULUTH HARBOR N PIER LIGHT, 1982	PE	VISUAL CALIBRATION
049	SKY HARBOR AIRPORT BEACON, 1982		VISUAL CALIBRATION
129	PION MNPT RM 1, 1977	NGS	VISUAL CALIBRATION
130	BARK 1953	NGS	VISUAL CALIBRATION
131	LONG, 1982	PE	VISUAL CALIBRATION
132	TAYLOR, 1982	PE	VISUAL CALIBRATION
133	GUANO, 1982		VISUAL CALIBRATION
134	GUANO SIGNAL, 1982	PE	VISUAL CALIBRATION
135	AMNICON 2, 1982	PE	VISUAL CALIBRATION
138	SUPERIOR ENTRY S BREAKWATER LT, 1982		VISUAL CALIBRATION

All horizontal control used in this survey is based on the North American Datum of 1927. A complete list of signals is located in Appendix F of this report. Geodetic abstracts and computations for all PEIRCE control work are included in the project Horizontal Control Report. All stations used in this survey meet

the required Third Order, Class I accuracy standards. Positions of NGS stations were obtained from the NGS data base printout for western Lake Superior.

G. HYDROGRAPHIC POSITION CONTROL - See section 4 of the Evaluation Report

The positional control system used for this survey was the DM-54 Automatic Ranging Grid Overlay (ARGO) positioning system. Two time slots were used on each vessel to give a one second update with a smoothing code of 2 and an ARGO frequency of 1646.70 KHz. Fixed shore station AGC values and antenna range/tune values were recorded hourly during the hours of hydrography and are included in the supplemental data to this report.

The electronic equipment used for this survey follows:

VESNO	EQUIPMENT	S/N	JD
2830	Range Processing Unit	RO47843	214-288
	Control Display Unit	CO47823	214-288
	Power Supply Unit	VO38167	214-288
2837	Range Processing Unit	RO47854	231
	Control Display Unit	CO47834	231
	Power Supply Unit	VO379124	231
2839	Range Processing Unit	RO379112	232
	Control Display Unit	CO47824	232
	Power Supply Unit	VO379112	232

STATION	EQUIPMENT	S/N	JD
MN PT ARGO 1980, 114	Antenna Loading Unit	A0379120	214-288
	Range Processing Unit	R047864	214-238
	Power Supply Unit	VO379127 H46339	214-238 266-288
WICK 1981, 102	Antenna Loading Unit Range Processing Unit	A079127 R047855	214-288 214-288
	Power Supply Unit	V0478103	214-288
ANDERSON RM I 1981, 113	Antenna Loading Unit	A0379109	214-288
	Range Processing Unit	R0379115	214-238
	Power Supply Unit	V0379119 V0478106	214-288 228-288

The ARGO positioning system was generally calibrated twice daily using three point sextant fixes with a check fix. On-line partial rate correctors to the ARGO positioning system were based on each day's opening calibration and entered into the program via the Nav-cal feature of RK 112. The average of the opening and closing calibration was used as the final corrector value, and was applied via the off-line corrector tape. A total of eight calibration sites were used because of the large survey area. All calibrations of the ARGO positioning system can be found in Appendix E.

The fresh water operating area necessitated the calculation of a pseudo ARGO frequency. This was necessary because of the HYDROPLOT's preprogrammed seawater propogation velocity of 299,670 km/s. Our first pseudo calculation used the

"Great Lakes" velocity of 299, 350 km/s from Table 4-3 of the HYDROGRAPHIC MANUAL. While attempting to use this value, calibrations in different parts of the working area showed large partial lane corrector variations. This indicated that the pseudo frequency in line (2) below was not correct. By iteration, a new pseudo frequency was determined that forced partial correctors from two widely separated calibration areas to agree. This value is shown in line (3) and was confirmed by calibrations in a total of six widely separated areas and by a baseline crossing on Julian Day 234. This pseudo frequency, 1647.22 KHz, was added to all signal tapes for this project.

	VELOCITY (KM/S)	SOURCE	FREQUENCY (KHZ)	SOURCE
(1)	299,670	Programmed in HYDROPLOT	1646.70	True frequency of ARGO system
(2)	299,350	Table 4-3. HYD. MANUAL	1648.46	Calculated pseudo freq.
(3)	299,575.4	Calculated from freq. at right	1647.22 (ON SIGNAL TAPE)	Iterative pseudo freq.

Baseline crossing confirmation data follows:

WICK	ANDERSON RM I	
362.72 lanes	70.21	Minimum rates
-.35	-.93	Partial correctors
362.37	69.28	Corrected # of lanes
+69.28		
431.65	Total number of lanes between stations	

39,258.817 meters, inverse distance
-431.65 total lanes
90.951 meters/lane

299,670 km/s (HYDROPLOT)
- 2*1,647.22 KHz (Signal tape)
90.962 meters/lane

Difference = 0.011 meters/lane or 0.21 KHz or 0.00012 lanes.

On days 230, 232, 233, 234, 235, 286, 287 and 287 hydrography was run throughout the day and night. Before night hydrography was attempted, a large scale static

plot was done to ensure there would be no intolerable accuracy degradation during the night. This test was repeated several times while at anchor and while alongside the Duluth Arena Pier. Satisfactory accuracy was confirmed.

During this survey seventeen hours were lost due to electronic equipment failures. Fourteen of these hours were lost due to problems on the two launches.

On JD 229 frequent illegal interrupts were noted on the printout. These interrupts were caused by radio transmissions on the ship's high frequency radio. The evening calibration showed that no lanes had been lost.

On day 233 edit marks were noted on the strip chart recorder. These were probably caused by rain showers that were in the area. At the end of the day, the calibration indicated that no lanes had been lost.

On day 234, shortly after the evening calibration, a lightning storm moved into the survey area. Survey operations were suspended for the night. No edit marks were noted before suspending operations. Calibration the following morning showed that no lanes had been lost during the storm.

On JD 237, thirty-eight lanes were lost on MN PT ARGO which was not in use at the time. These lanes were lost after position 1490 while this station had not been used since position 1435. Stations WICK and ANDERSON RM 1 were being used for positioning at that time. The problem is believed to have been caused by a storm in the area. It is recommended that all data be kept.

On JD's 235, 285 and 286 erratic steering needles and edit marks were noted. On each of these days there were rain showers in the survey area. Closing calibrations on each of the days showed no loss of lanes.

On JD's 224 and 233 the ship calibrated at Bark Bay. The partial correctors from these calibrations differed from those of other calibration sites. Grazing land path may be the cause of the problem. These correctors are presently included in the daily correctors on the corrector tapes.

H. SHORELINE ✓

There is no shoreline included within the limits of this survey.

I. CROSSLINES ✓

A total of 374 nautical miles of crosslines were run on this survey. This constitutes over 14% of the total mainscheme hydrography. Crossline soundings agreed very well with the mainscheme hydrography, falling well within the 1-3% of depth criterion (Sec. 1.1.2 of the Hydrographic Manual).

J. JUNCTIONS - See section 5 of the Evaluation Report

This survey junctions with H-10024 (PE-20-1-82) to the west and H-10043 (PE-20-2-82) to the south. Both surveys compared very well with all soundings agreeing within three feet. The survey to the west did not have any overlapping soundings but the contour lines are very consistent from one sheet to another. The survey to the south had overlapping soundings. No discrepancies or irregularities were found between the surveys.

K. COMPARISON WITH PRIOR SURVEYS - See sections 4.i, 6, and 7.a of the Evaluation Report.

There were no presurvey review items located within the limits of this survey.

Comparisons were made with the following prior surveys:

SURVEY	SCALE	YEAR SURVEY
LS-256	1:200,000	1861-1868
LS-257	1:60,000	1861
LS-1505	1:120,000	1927
LS-1492	1:20,000	1927
LS-1493	1:20,000	1927
LS-1490	1:20,000	1927
LS-1491	1:20,000	1927
LS-1994	1:20,000	1956

All of these are U.S. Army Corps of Engineers Lake Survey Center surveys. There are no prior N.O.S. Surveys.

Comparisons with prior surveys LS-256 and LS-257 were very difficult since they contained no latitude or longitude lines. LS-256 was put on a light table projector and enlarged to a scale of 1:50,000. The shoreline was used to control the expansion. The shoreline matched poorly with the chart blow-up. Though only a vague comparison could be made, it could be seen that the soundings on the prior survey were much shoaler than

the current survey. There is no pattern to the inaccuracy of the prior survey. Many of the erroneous soundings on the current chart come from the 1861 survey.

Prior surveys LS-1492, LS-1493, LS-1490, and LS-1491 were all done in 1927. Overall, these surveys compared very well with most soundings differing by less than three feet. The prior surveys were generally shoaler. All of the surveys used the Datum of 600.5 feet above the mean tide at New York.

Prior survey LS-1505 was done in 1928. This survey was done with a wire sounding machine and compared very well with the current survey. The two worst discrepancies were at 46°58.0'N, 091°28.5'W where the sounding was ~~thirty~~ forty-four feet deeper than the current survey and at 46°58.0'N, 091°32.5'W where the sounding was ~~sixteen~~ forty-three feet deeper than the current survey.

Prior survey LS-1994 was done in 1956 using Shoran positioning. This survey had a Datum of 601.6 feet above the mean tide at New York. The sheet also included soundings from surveys done in 1902 and 1927 and soundings from the contemporary chart. The soundings from the other surveys and chart were placed on the sheet using a color code. The sheet was then copied in black and white making it impossible for the hydrographer to distinguish between the soundings. In general, the soundings shoaler than 400 feet were very accurate. Soundings deeper than 400 feet were usually inaccurate to varying degrees with no pattern being evident. The greatest inaccuracy found was at 46°58.9'N, 091°05.8'W where the prior survey shows a sounding of 324 feet, ~~ninety~~ forty feet deeper than the current survey.

It is recommended that the current survey supersede all prior surveys, in the area . Because of the large number of inaccurate prior soundings, the hydrographer recommends that no prior soundings be used.

L. COMPARISON WITH THE CHART - See Section 7.a of the Evaluation Report

Comparisons were made with Chart 14966, 18th Edition, 22 December 1979, scale 1:120,000. The survey disagreed drastically with the chart.

"Of the 381 charted soundings in the survey area, survey H-10036 disagrees drastically with 132 soundings (35%) and disgrees to a lesser extent with at least that many more. These erroneous charted soundings are distributed through-out the survey, in all depths and in all bottom types"[1].

To disprove these charted soundings, 25 soundings were chosen at random throughout the survey area. These areas were resurveyed with near 100 percent bottom coverage using the Ross and UGR echo sounders simultaneously. All resurveyed chart soundings were disproven. The discrepancies varied from a few feet to 200 feet. All of the disproved soundings are deeper than 150 feet. These developments were not ploted on the final sheet. All of the fathograms were scanned to make sure the water was not shoaler than found originally in this survey.

It is recommended that presently charted depths be replaced completely with depths from this survey.

l) Letter to Director, Alantic Marine Center, from Commanding Officer, NOAA Ship PEIRCE S-328, dated 20 October 1982. Copy in Appendix J.

M. ADEQUACY OF SURVEY ✓

This survey is complete and adequate to supersede the presently charted soundings and prior surveys of the area. It is recommended that presently charted depths be replaced completely with depths from this survey.

N. AIDS TO NAVIGATION ✓

The following landmarks and fixed aids were visually verified during the survey:

TWO HARBORS LIGHTHOUSE

TWO HARBORS RADIO MAST

Two Harbors East Breakwater Light

Two Harbors West Breakwater Light

Knife River Harbor Entrance Light

Port Wing East Pier Light

Sand Island Light

Stack, Municipal Water and Light Plant in Two Harbors

Tank FR, 1½ mile north of Two Harbors

Split Rock Lighthouse was also visually verified as existing. The light was observed to be operational from PEIRCE on several occasions. However, the light operating schedule is not published, since the light is not intended for navigational purposes and is not operated on a regular schedule. This is on the chart as ABAND LT HO.

O. STATISTICS ✓

	Vesno 2830	Vesno 2837	Vesno 2839	Total
Total Number of Positions	2386	20	56	2462
Nautical Miles of Sounding Lines	2144.4	53.3	41.5	2239.2
Square Miles of Hydrography	380.8	---	---	380.8
Bottom Samples	47	0	0	47
Water Level Stations	---	---	---	5
Current Stations	---	---	---	0
XBT's	7	0	0	7
Martek Casts	3	0	0	3
Magnetic Stations	---	---	---	0
Settlement and Squat	1	1	1	3
Nansen	1	0	0	1

P. MISCELLANEOUS ✓

Fourty-seven bottom samples were taken during this survey; a copy of the Oceanographic Log Sheet "M" is included in Appendix H.

The area North and East of 47°02.0'N and 091°16.0'W has a very irregular bottom. The area has many peaks, ridges, holes and valleys, all between 560 feet and 650 feet deep.

Q. RECOMMENDATIONS

It is recommended that this survey supersede all existing charts and prior surveys. Specific recommendations were made in sections L and M of this report. No additional field work is required.

R. AUTOMATED DATA PROCESSING

The followng programs were used in acquiring and processing data for this survey:

Program	Program Name	Version
112	Hyperbolic R/R Hydroplot	08/04/81
201	Grid, Signal, Lattice Plot	04/17/81
211	Range/Range Non Real Time Plot	02/02/81
300	Utility Computations	10/21/80
330	Reformat and Data Check	05/04/76
360	Electronic Corrector Abstract	02/02/76
530	Layer Corrections for Velocity	05/10/76
561	H/R Geodetic Calibration	02/19/75
602	Elinore-Extended Line Oriented Editor	05/21/75
612	Line Printer List	03/22/78

S. REFERRAL TO REPORTS ✓

Five water level stations were in the survey area. See Field Water Level Note in Appendix B of this report. This report, Leveling Records, and Monthly Water Level Records have been submitted to Water Levels Branch, Rockville, Maryland. A Coast Pilot report was submitted in December 1982.

The 1982 PEIRCE horizontal control and magnetics reports have been submitted to Operations Division, Atlantic Marine Center, January, 1983.

Respectfully, submitted

Martin P. Conricote

MARTIN P. CONRICOTE, LTJG, NOAA

APPENDIX K

APPROVAL SHEET

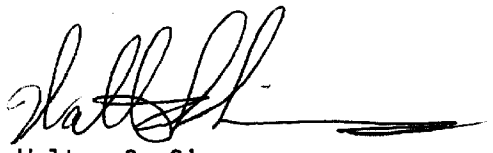
APPROVAL SHEET

H-10036

Field work on this survey was conducted under my supervision with frequent personal examination of the field sheet and records. This report and the final field sheet have been reviewed and found to represent a complete and adequate survey.

No additional field work is required. This survey should supersede all prior surveys and charted information in the common areas.

Until such time as a new chart is constructed, the geographic position of any information from this survey must be converted to chart datum before application. Horizontal datum for this survey is NAD 1927.



Walter S. Simmons
Commander, NOAA
Commanding Officer
NOAA Ship PEIRCE

APPENDICES

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* H. BOTTOM SAMPLES
  I. LANDMARKS FOR CHARTS
  J. DISPROVAL OF CHARTED SOUNDINGS
  K. APPROVAL SHEET

* Removed from Descriptive Repat and filed with Original Survey Records.

APPENDIX F

LIST OF STATIONS

SIGNAL NAME LIST

SIGNAL#	NAME	SOURCE	YEAR
102	WICK	AMC	1981
103	TWO HARBORS LIGHTHOUSE	NGS*	1952
104	PICNIC AZ MK	AMC	1981
105	PICNIC	AMC	1981
106	LAKEWOOD	AMC	1981
107	TALMADGE 1952	NGS*	1952
108	BUCHANAN 1952	NGS*	1952
109	TWO HARBORS RADIO MAST	NGS*	1977
110	FLOOD	AMC	1981
112	BACHAN MNDT 1977	NGS*	1977
113	ANDERSON RM 1	AMC	1981
114	MN PT ARGO	AMC	1980
122	SPIT	WH	1981
123	CABIN SIGNAL	WH	1981
124	MIDDLE RIVER SIGNAL	WH	1981
125	EROSION	AMC	1981
126	ORIENTA	AMC	1981
127	ANDERSON RM 2	AMC	1981
128	QUARRY INN	AMC	1981
002	DULUTH ENGER MEMORIAL TOWER	NGS*	1952
044	DULUTH HARBOR N PIER LIGHT	PE	1982
129	PION MNDT RM 1 1977	NGS*	1977
130	BARK 1953	NGS*	1953
131	LONG	PE	1982
132	TAYLOR	PE	1982
134	GUANO SIGNAL	PE	1982
135	AMNICON 2	PE	1982
ϕ49	SKY HARBOR AIRPORT BEACON	PE	1982
138	SUPERIOR ENTRY S BREAKWATER LT	PE	1982

* NGS Data Base for Western Lake Superior.

*- Station not used

SIGNAL TAPE

PE-50-1-82

H-10036

101	0	46	51	55621	091	59	16257	250	0167	000000	*
102	0	47	07	31515	091	28	54048	250	0000	164722	
103	0	47	00	50488	091	39	49274	250	0000	000000	
104	0	46	52	11356	091	56	44877	250	0000	000000	
105	0	46	51	50022	091	57	24212	250	0000	000000	
106	0	46	52	25746	091	56	09102	250	0000	000000	
107	0	46	52	55054	091	55	04416	250	0015	000000	
108	0	46	55	26725	091	49	03659	250	0008	000000	
109	0	47	00	45259	091	41	13275	250	0000	000000	
110	0	47	02	29399	091	38	09524	250	0000	000000	
111	0	47	04	00433	091	35	38031	250	0065	000000	*
112	0	47	07	53065	091	27	56387	250	0004	000000	
113	6	46	46	22364	091	27	05678	250	0000	164722	
114	0	46	43	04575	092	02	05673	250	0000	164722	
119	5	46	41	10925	091	54	12292	139	0000	000000	*
121	7	46	41	24241	091	49	46058	139	0000	000000	*
122	4	46	41	24515	091	49	37164	139	0000	000000	
123	7	46	41	10594	091	54	11857	139	0000	000000	
124	6	46	41	23953	091	49	46038	139	0000	000000	
125	0	46	45	24672	091	30	42063	250	0000	000000	
126	5	46	46	04521	091	29	01814	250	0000	000000	
127	7	46	46	23305	091	27	02372	250	0000	000000	
128	5	46	46	23191	091	27	09880	250	0000	000000	
001	0	46	47	24342	092	06	49759	250	0201	000000	*
002	0	46	46	34185	092	07	29003	139	0000	000000	
004	0	46	47	20600	092	05	59841	139	0000	000000	*
006	0	46	45	38602	092	05	55842	139	0000	000000	*
008	0	46	45	41758	092	04	46747	139	0000	000000	*
009	0	46	45	30810	092	04	41470	139	0000	000000	*
010	4	46	45	27978	092	04	42663	139	0001	000000	*
013	0	46	42	12117	092	02	48974	139	0000	000000	*
024	0	46	50	46593	092	04	37183	139	0000	000000	*
026	7	46	42	49521	092	01	54535	250	0002	000000	*
028	6	46	43	04575	092	02	05673	250	0000	000000	*
030	0	46	43	33060	092	05	25960	139	0042	000000	*
031	0	46	43	02740	092	05	28500	139	0039	000000	*
032	0	46	42	08886	092	01	24635	139	0038	000000	*
033	0	46	41	30098	092	00	49170	139	0057	000000	*
034	0	46	46	46130	092	05	35070	139	0043	000000	*
044	5	46	46	51551	092	05	17035	250	0000	000000	
045	0	46	52	54873	091	55	04999	250	0015	000000	
129	5	47	04	00755	091	35	37959	250	0082	000000	
130	5	46	53	08683	091	10	49935	250	0002	000000	
131	5	46	52	22326	091	08	05334	250	0005	000000	
132	5	46	52	56073	091	05	30363	250	0006	000000	
133	5	46	56	28288	091	02	11126	250	0006	000000	
134	5	46	56	28190	091	02	11059	250	0006	000000	
135	5	46	41	31974	091	51	25935	250	0002	000000	
136	5	46	42	21149	091	45	27909	250	0021	000000	*
137	5	46	42	19467	091	45	27250	250	0022	000000	*
138		46	42	36746	092	00	22249	139			
049		46	43	38179	092	02	46260	139			

APPENDIX I

LANDMARKS FOR CHART

NOAA FORM 76-40
(8-74)

Replaces C&GS Form 567.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NONFLOATING AIDS OR LANDMARKS FOR CHARTS

ORIGINATING ACTIVITY
- [X] HYDROGRAPHIC PARTY
- [ ] GEODETIC PARTY
- [ ] PHOTO FIELD PARTY
- [ ] COMPILATION ACTIVITY
- [ ] FINAL REVIEWER
- [ ] QUALITY CONTROL & REVIEW GRP.
- [ ] COAST PILOT BRANCH

(See reverse for responsible personnel)

- [ ] TO BE CHARTED
- [X] TO BE REVISED
- [ ] TO BE DELETED

REPORTING UNIT (Field Party, Ship or Office)	STATE	LOCALITY	DATE
SHIP PEIRCE	MINNESOTA WISCONSIN	LAKE SUPERIOR	11-19-82

The following objects HAVE [X] HAVE NOT [ ] been inspected from seaward to determine their value as landmarks.

OPR PROJECT NO.	JOB NUMBER	SURVEY NUMBER	DATUM
ORP-Z137		H-10036	GREAT LAKES

CHARTING NAME	DESCRIPTION (Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses)	POSITION LATITUDE ° ′	LATITUDE ″ D.M. Meters	POSITION LONGITUDE ° ′	LONGITUDE ″ D.P. Meters	METHOD AND DATE OF LOCATION (See instructions on reverse side) OFFICE	FIELD	CHARTS AFFECTED
TANK 2 VERT FL R F R	(BOMARC CHECKERED TANK, 1982	46 55	48.27	91 53	01.10		F-3-6-L 10-27-82	14966
FL G 2.5 SEC 20 FT 4ST M	CORNUCOPIA EAST PIER LIGHT (CORNUCOPIA EAST PIER LT, 1982 L.L #1788	46 51	35.12	91 06	16.15		F-3-6-L 10-27-82	14966

RESPONSIBLE PERSONNEL		
TYPE OF ACTION	NAME	ORIGINATOR
OBJECTS INSPECTED FROM SEAWARD		☐ PHOTO FIELD PARTY ☐ HYDROGRAPHIC PARTY ☐ GEODETIC PARTY ☐ OTHER *(Specify)*
POSITIONS DETERMINED AND/OR VERIFIED		FIELD ACTIVITY REPRESENTATIVE
		OFFICE ACTIVITY REPRESENTATIVE
FORMS ORIGINATED BY QUALITY CONTROL AND REVIEW GROUP AND FINAL REVIEW ACTIVITIES		☐ REVIEWER ☐ QUALITY CONTROL AND REVIEW GROUP REPRESENTATIVE

INSTRUCTIONS FOR ENTRIES UNDER 'METHOD AND DATE OF LOCATION'

(Consult Photogrammetric Instructions No. 64,

OFFICE

I. OFFICE IDENTIFIED AND LOCATED OBJECTS
Enter the number and date (including month, day, and year) of the photograph used to identify and locate the object.
EXAMPLE: 75E(C)6042
8-12-75

FIELD

I. NEW POSITION DETERMINED OR VERIFIED
Enter the applicable data by symbols as follows:

F - Field	P - Photogrammetric
L - Located	Vis - Visually
V - Verified	
1 - Triangulation	5 - Field Identified
2 - Traverse	6 - Theodolite
3 - Intersection	7 - Planetable
4 - Resection	8 - Sextant

A. Field positions* require entry of method of location and date of field work.
EXAMPLE: F-2-6-L
8-12-75

*FIELD POSITIONS are determined by field observations based entirely upon ground survey methods.

FIELD (Cont'd)

B. Photogrammetric field positions** require entry of method of location or verification, date of field work and number of the photograph used to locate or identify the object.
EXAMPLE: P-8-V
8-12-75
74L(C)2982

II. TRIANGULATION STATION RECOVERED
When a landmark or aid which is also a triangulation station is recovered, enter 'Triang. Rec.' with date of recovery.
EXAMPLE: Triang. Rec.
8-12-75

III. POSITION VERIFIED VISUALLY ON PHOTOGRAPH
Enter 'V-Vis.' and date.
EXAMPLE: V-Vis.
8-12-75

**PHOTOGRAMMETRIC FIELD POSITIONS are dependent entirely, or in part, upon control established by photogrammetric methods.

SUPERSEDES NOAA FORM 76-40 (2-71) WHICH IS OBSOLETE, AND EXISTING STOCK SHOULD BE DESTROYED UPON RECEIPT OF REVISION.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1974-665-073/1030 Region 6

DANGERS TO NAVIGATION

NEGATIVE REPORT TO DANGERS TO NAVIGATION

APPENDIX J

DISPROVAL OF CHARTED SOUNDINGS

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SURVEY
ATLANTIC MARINE CENTER
439 West York Street
Norfolk, Virginia 23510

September 21, 1982 OA/CAM103:RWJ

TO: Commanding Officer
NOAA Ship PEIRCE

FROM: Richard H. Houlder
Director, Atlantic Marine Center

SUBJECT: Disproval of Charted Soundings on OPR-Z137

REF: PEIRCE Letter Dtd 9/8/82

Background assumptions that were not stated in the referenced letter:

1. The prior surveys in question have leadline depths and visual control.

2. The horizontal control around the lake for hydrography has traditionally been poor even in recent years. Harbor areas are accurately positioned within that area, but each area is not well positioned relative to each other or the NGS network.

3. The areas with the doubtful soundings are near shore, possibly in close proximity to the steep and rocky fall off along the north shore.

4. H-10024 main scheme lines were run at 800m spacing and splits resulted in 400m spacing.

5. The Ross fathometer was used for all soundings less than 100 fathoms.

Experience with other prior surveys indicate that depth data was good; however, position accuracy was questionable, especially if well positioned shore signals and geometrically strong fixes were not possible. This could potentially be the situation around Lake Superior.

The narrow-beam Ross echo sounder is an excellent digital source, but a poor search tool. Assuming a 300 foot depth and 400m spacing, only 2.8% of the bottom is observed. Leadline survey data are discrete point data so that any shoal depth must be construed as a possible indication of a shoal and not necessarily the least depth in that area.

Considering these, it appears the survey would be incomplete if developments were not run over all, or a representative sample of these charted soundings. While conducting these developments, it is desirable to be concurrently using the Ross for digitizing and the UGR for increased bottom coverage (14-20% in same condition).

A particular prior survey maybe discredited if all the following conditions are met:

1. Representive discrepancies from each prior survey are thoroughly developed.

2. These developed discrepancies are evenly distributed across the entire prior survey.

3. Each prior survey must be evaluated separately even if done during the same year, by the same party, or over common areas.

The investment of 60 hours of ship time does not seem an exorbitant investment to correct the chart and the data base for all users. Without the indicated developments, it is doubtful that the charted soundings would be changed based only on the presumption that the prior surveys were incorrect.

cc:
OA/C3

AU/025
NCC ZDK
AU/022

P 161846Z SEP 82
FM NOAACAM NORFOLK VA
TO NOOAS PEIRCE
CM GRNC
BT
UNCLAS
SUBJ: FY83 OPR-Z137 SURVOPS
REF: UR 3 LTRS 8 SEP 82
1. PE OPR-Z137 SURVOPS CY83 EXPECTED TO EITHER:
A. CON'T W TO E ALONG S. SHORE W/1:20K SURVEYS INCLUDE APOSTLE ~~ISLAND~~ Islands
B. CON'T SHIP ONLY HYDRO W/1:50K SURVEYS W TO E TO COMPLETE MAX ~~POSSE~~ Possible AREA.
2. PLAN A IS THE PRESENT/PREFERRED. B NECESSARY IF MT MITCHELL LAY-UP CERTAIN IN FY84 TO MAXIMIZE LAST SHIP HYDRO IN G. LAKES. REMAINING HYDRO TO BE DONE BY FIELD PARTY AS POSSIBLE.
3. REGARDS BOTTOM SAMPLES:
A. REQMT FOR B.S. IN DEPTHS GREATER 120 FT REMAINS. IF NO PRIOR DATA AVAILABLE, 12 CM SPACING REQD. IF SUFFICIENT PRIOR DATA AND IDENTICAL PRESENT DATA, DOUBLE 24 CM SPACING AUTHORIZED.
B. SAME REQMT IN DEPTHS LESS 120 FT. 12 CM DOUBLE SPACING AUTHORIZED.

PAGE 2 UEBNSA1846 UNCLAS
ANY AREA NOT IDENTICAL TO PRIOR REQD 6 CM TO DEFINE LIMIT OF CHANGE.
4. REGARDS DISPROVAL OF CHARTED SOUNDINGS:
A. OTHER CAUSES OF DISCREPANCIES EXIST ESP. POSITIONING/HORCON IN-ACCURACIES ON PRIORS.
B. 400M SPACING USING ROSS YIELDS LESS THAN 3 BOTTOM COVERAGE. THIS IS INSUFFICIENT TO DISPROVE CHARTED DATA.
C. FURTHER SPLIT AND DEVELOP AREA(S) AS MORE SUBSTANTIAL DISPROVAL JUSTIFICATION. SUGGEST CONCURRENT USE OF ROSS AND UGR FOR GREATER BOTTOM COVERAGE.
5. ADEQUATE COMPLETION OF SURVEYS IN PROGRESS HIGHEST PRIORITY. PRESENT SURVEYS EXPECTED TO BE MAIN DATA BASE FOR ALL FUTURE NEEDS IN SUBJECT AREA NOT JUST NAUTICAL CHARTING.
BT

TOD-
TOD-09:16:22:13

NNNN

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SURVEY
NOAA Ship PEIRCE S-328
439 West York Street
Norfolk, Virginia 23510

October 20, 1982

TO: Director, Atlantic Marine Center

Associate Director, Marine Surveys and Maps

FROM: Commanding Officer, NOAA Ship PEIRCE S-328

SUBJECT: Disproval of Charted Soundings, PE-50-1-82 (H-10036)

Based upon further development of erroneous charted soundings within the PE-50-1-82 survey, PEIRCE again recommends that no further field work be expended on this survey.

In accordance with Atlantic Marine Center message P 161846Z September 82, and verbal instructions by telephone from CAM-1, PEIRCE has devoted 82 additional ship hours to disproval of charted soundings. Both the Ross and the UGR echo sounders were used to obtain near 100 percent bottom coverage plus crosslines as specified by CAM-1.

This exercise resulted in disproval of all 25 soundings investigated. There was no indication of any of these charted soundings, and there were no soundings shoaler than those found by the main scheme lines.

Of the 381 charted soundings in the survey area, PEIRCE surveys disagree drastically with 132 soundings (35%) and disagrees to a lesser extent with at least that many more. These erroneous charted soundings are distributed throughout the survey, in all depths, and in all bottom types.

PEIRCE chose a random sample of the 132 disputed charted soundings throughout the survey for detailed investigation. This procedure was selected because prior surveys were not available to be individually discredited as specified by CAM-1.

The following is a summary of activities on PE-50-1-82:

	Ship days	Ship hours	Miles sdg.	Soundings Shoaler than main scheme
Main Scheme	9	114	1096	-
Development (basic survey)	1	4	24	0
Crosslines (basic survey)	3	14	92	0
Total (basic survey)	13	132	1212	0

	Ship Days	Ship hours	Miles sqy.	Soundings Shoaler than main scheme
PEIRCE selected crosslines and splits to disprove chart	4	49	282	0
Extra development to disprove chart per CAM-1	4	82	407	0
Total (disprove chart)	8	131	689	0

PEIRCE has never before seen a survey disagree with 35 percent or more of charted soundings in the common area. Experience has shown that charted soundings are generally accurate in depth if the entire prior survey is shifted slightly to account for errors in horizontal control, positioning, or datum shifts. In the area of PE-50-1-82 none of the above adjustments is valid

When charts are found to be so drastically in error, less survey effort should be required to discredit the soundings than would be required to disprove a normal chart.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

WATER LEVEL NOTE FOR HYDROGRAPHIC SHEET

Processing Division: Atlantic Marine Center: MOA231

Hourly heights are approved for

Water Level Station Used: Two Harbors, Minnesota (909-9070)

Period: August 2, 1982 - October 15, 1982

HYDROGRAPHIC SHEET: H-10036

OPR- Z137-PE-82

Locality: Lake Superior

Plane of reference: Low Water Datum (IGLD 1955 : 600.00 Feet)

Remarks:

Zoning not required. Data from other gages on Lake Huron indicates no unusual water level movement during the survey period.

Philip C. Marvin

Chief, Water Levels Section

NOAA FORM 76-155
(11-72)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

GEOGRAPHIC NAMES

SURVEY NUMBER

H-10036

Name on Survey	A ON CHART NO.	B ON PREVIOUS SURVEY NO.	C ON U.S. QUADRANGLE MAPS	D FROM LOCAL INFORMATION	E ON LOCAL MAPS	F P.O. GUIDE OR MAP	G RAND MCNALLY ATLAS	H U.S. LIGHT LIST	K	
LAKE SUPERIOR										1
MINNESOTA (title)										2
SAND ISLAND (title)										3
STONY POINT (title)										4
WISCONSIN (title)										5
										6
										7
										8
										9
										10
										11
										12
										13
										14
										15
										16
										17
										18
					Approved:					19
										20
					Charles E. Harrington					21
					Chief Geographer - N/CG2x5					22
					SEP 28 1984					23
										24
										25

NOAA FORM 76-155 SUPERSEDES C&GS 197

HYDROGRAPHIC SURVEY STATISTICS
REGISTRY NO.: H-10036

Number of positions	1614
Number of soundings	10755
Number of control stations	34

	TIME-HOURS	DATE COMPLETED
Preprocessing Examination	22	28 FEB 1983
Verification of Field Data	408	6 SEP 1984
Quality Control Checks	63	
Evaluation and Analysis	75	28 SEP 1984
Final Inspection	6	27 SEP 1984
TOTAL TIME	574	

Marine Center Approval 28 SEP 1984

Transmittal letter of survey and survey records will be included in the Descriptive Report to identify the records accompanying the survey.

ATLANTIC MARINE CENTER
EVALUATION REPORT

REGISTRY NO.: H-10036 FIELD NO.: PE 50-1-82

Minnesota--Wisconsin, Lake Superior, Offshore--Between Sand Island and Stony Point

SURVEYED: 2 August through 15 October 1982

SCALE: 1:50,000 PROJECT NO.: OPR-Z137-PE-82

SOUNDINGS: Ross Digital Echo Sounder, Raytheon Universal Graphic Recorder (UGR)

CONTROL: Cubic Western DM-54 ARGO (Range/Range)

Chief of Party.....W. S. Simmons

Surveyed by.....G. E. Leigh
.....N. G. Millett
.....R. M. Mandzi
.....R. B. Harris
.....M. P. Conricote
.....S. I. Andreeva

Automated Plot by.....Xynetics 1201 Plotter (AMC)

1. INTRODUCTION

a. No unusual problems were encountered during office processing of this survey.

b. Notes in the Descriptive Report were made in red during office processing.

2. CONTROL AND SHORELINE

a. Control is adequately discussed in sections F, G, and S of the Descriptive Report.

b. There is no shoreline within the area surveyed.

3. HYDROGRAPHY

a. Soundings at crossing agree within the limits prescribed in sections 4.6.1 and 6.3.4.3 of the Hydrographic Manual and section 6.6 of the Project Instructions.

b. The standard curves could be drawn in their entirety. Dashed and supplemental curves were drawn to show additional bottom relief.

j. Sections A through S of the Descriptive Report should have been single spaced in order to reduce the bulk of the report.

k. The hydrographer should be commended for his efforts to verify/disprove the numerous erroneous charted soundings mentioned in section 3.c. of this report.

l. The hydrographer should be commended for his efforts in the determination of velocity of propagation over freshwater and subsequent frequency determination for use with the HYDROPLOT/HYDROLOG system.

5. JUNCTIONS

H-9979 (1981) to the southwest
H-10024 (1982) to the west
H-10043 (1982) to the south
H-10094 (1983) to the north
H-10095 (1983) to the south
H-10096 (1983) to the southeast
H-10100 (1983) to the east

Excellent junctions were effected between the above surveys and the present survey.

There are no contemporary surveys to the northwest of the present survey. Charted hydrography and the present survey soundings are in harmony.

6. COMPARISON WITH PRIOR SURVEYS

LS-256 (1861-1868) 1:200,000
LS-257 (1861) 1:60,000
LS-1490 (1927) 1:20,000
LS-1491 (1927) 1:20,000
LS-1492 (1927) 1:20,000
LS-1493 (1927) 1:20,000
LS-1505 (1928) 1:120,000
LS-1994 (1956) 1:20,000

The above surveys taken together cover the present survey in its entirety.

LS-256 (1861-68) and LS-257 (1861) cover offshore areas and compare favorably with the present survey. There is no general trend in depth differences. Comparison was made difficult because there was no grid on the prior surveys.

Prior surveys LS-1490-1493 (1927) cover an area along the southern edge of the present survey. These four (4) surveys compare well with the present survey. Prior survey soundings vary plus or minus (+/-) three (3) to five (5) feet from the present survey soundings.

c. Development of the bottom configuration and determination of least depths is considered adequate.

4. CONDITION OF SURVEY

The smooth sheet and accompanying overlays, hydrographic records and reports are adequate and conform to the requirements of the Hydrographic Manual except as follows:

a. The signal list submitted in the Descriptive Report was not complete. Two (2) additional stations were inserted into the records during office processing.

b. Eight (8) visually verified fixed aids to navigation and landmarks are listed in section N of the Descriptive Report. There are only two (2) fixed aids to navigation and/or landmarks listed on the NOAA Form 76-40 in Appendix I of Descriptive Report. This is not in compliance with section 4.2.2 of the Project Instructions and sections 4.5.13.1 and 5.5 of the Hydrographic Manual.

c. A vertical cast was not performed for the NOAA Ship PEIRCE to determine if there was any instrument error. In this case, such a determination is even more important because both ship and launch work was performed on the same survey. See section 4.9.5.1.2 of the Hydrographic Manual.

d. All velocity tables prepared by the field unit were revised during office processing. The velocity correction values were not properly selected from the velocity graphs by the hydrographer.

e. Neither original data or copies of the original data for determination of corrections to echo sounding were submitted to the Verification Section as required by section 5.3.5(H) of the Hydrographic Manual.

f. Three (3) unmonumented control stations, CABIN SIGNAL, GUANO SIGNAL and MIDDLE RIVER SIGNAL, were located by ship personnel. They were assigned cartographic code 139, recoverable triangulation, or code 250, recoverable triangulation used as an electronic positioning system site. Because the signals are not described and are not recoverable, they do not meet the standards for the cartographic codes 139 and 250. The proper cartographic codes were applied during office processing.

g. Loran C data was not recorded as required in section 8.4 of the Project Instructions.

h. The survey data package was not submitted within the six (6) week limit prescribed in section 6.13 of the Project Instructions. The survey data package was submitted five (5) weeks late.

i. Presurvey Review Item 13 (AWOIS Item 2388), the steamer, "BENJAMIN NOBLE," in Latitude 46°56'00"N, Longitude 91°46'00"W was not addressed by the hydrographer. This wreck falls in the northwestern corner of the present survey.

LS-1505 (1927) covers the central section of the present survey and compares well with the present survey. The present survey is generally five (5) to ten (10) feet shoaler than the prior survey.

The differences between the above prior surveys and the present survey can be attributed to improved hydrographic surveying methods and equipment, and changes in the horizontal and vertical datums.

LS-1994 (1956) covers the majority of the present survey area. The prior survey soundings are generally five (5) to twenty (20) feet deeper than the present survey soundings. These differences can be attributed to improved hydrographic surveying methods and equipment, and changes in the horizontal and vertical datums, and the possibility that sound velocity correctors were not applied to the prior survey soundings.

The present survey is adequate to supersede the prior surveys in the common area.

7. COMPARISON WITH CHART 14966 (18th Edition, Dec 22/79)

a. Hydrography

The charted hydrography originates with the previously discussed prior surveys and miscellaneous sources. Twenty-five (25) of the presently charted soundings were developed with reduced line spacing and simultaneous use of two (2) different sounding systems. These soundings were developed because they were a sampling of the charted information which was not supported by the present survey data or by prior surveys previously discussed. These charted soundings varied from ten (10) to two hundred fourteen (214) feet from the soundings on the present survey. After a thorough examination of these data, it was concluded that the present survey soundings were correct and that all charted hydrography should be superseded. These developments were not plotted on the survey smooth sheet but were plotted on page size sheets that are consecutively numbered and inserted in the Descriptive Report with the appropriate number. The developments were placed in the Descriptive Report because they add no significant additional information to the portrayal of the bottom configuration.

Presurvey Review Item 13 (AWOIS Item 2388), the steamer, "BENJAMIN NOBLE," sunk in 1914, originates with GUIDE TO SUNKEN SHIPS IN AMERICAN WATERS, A. L. Lonsdale and H. R. Kaplan, Compass Publications, 1964, in Latitude 46°56'00"N, Longitude 91°46'00"W. This was an information item on the AWOIS listing; no indication was found on the echogram. It is recommended that this item be charted as a non-dangerous sunken wreck, PA, in Latitude 46°56'00"N, Longitude 91°46'00"W.

The present survey is considered adequate to supersede the charted hydrography within the common area.

b. Aids to Navigation

There are no fixed or floating aids to navigation within the survey area.

8. COMPLIANCE WITH PROJECT INSTRUCTIONS

This survey adequately complies with the Project Instructions except as noted in section 4 of this report.

9. ADDITIONAL FIELD WORK

This is a good basic survey; no additional field work is recommended.

Douglas V. Mason
Cartographic Technician
Verification of Field Data

Robert G. Roberson
Senior Cartographer
Evaluation and Analysis

Leroy G. Cram
Supervisory Cartographic Technician
Verification Check

Inspection Report
H-10036

The completed survey has been inspected with regard to survey coverage, delineation of depth curves, development of critical depths, cartographic symbolization, and verification or disproval of charted data. The digital data have been completed and all revisions and additions made to the smooth sheet during survey processing have been entered in the magnetic tape record for this survey. Final control, position, and sounding printouts of the survey have been made. The survey complies with National Ocean Service requirements except as noted in the Evaluation Report. The survey records comply with NOS requirements except where noted in the Evaluation Report.

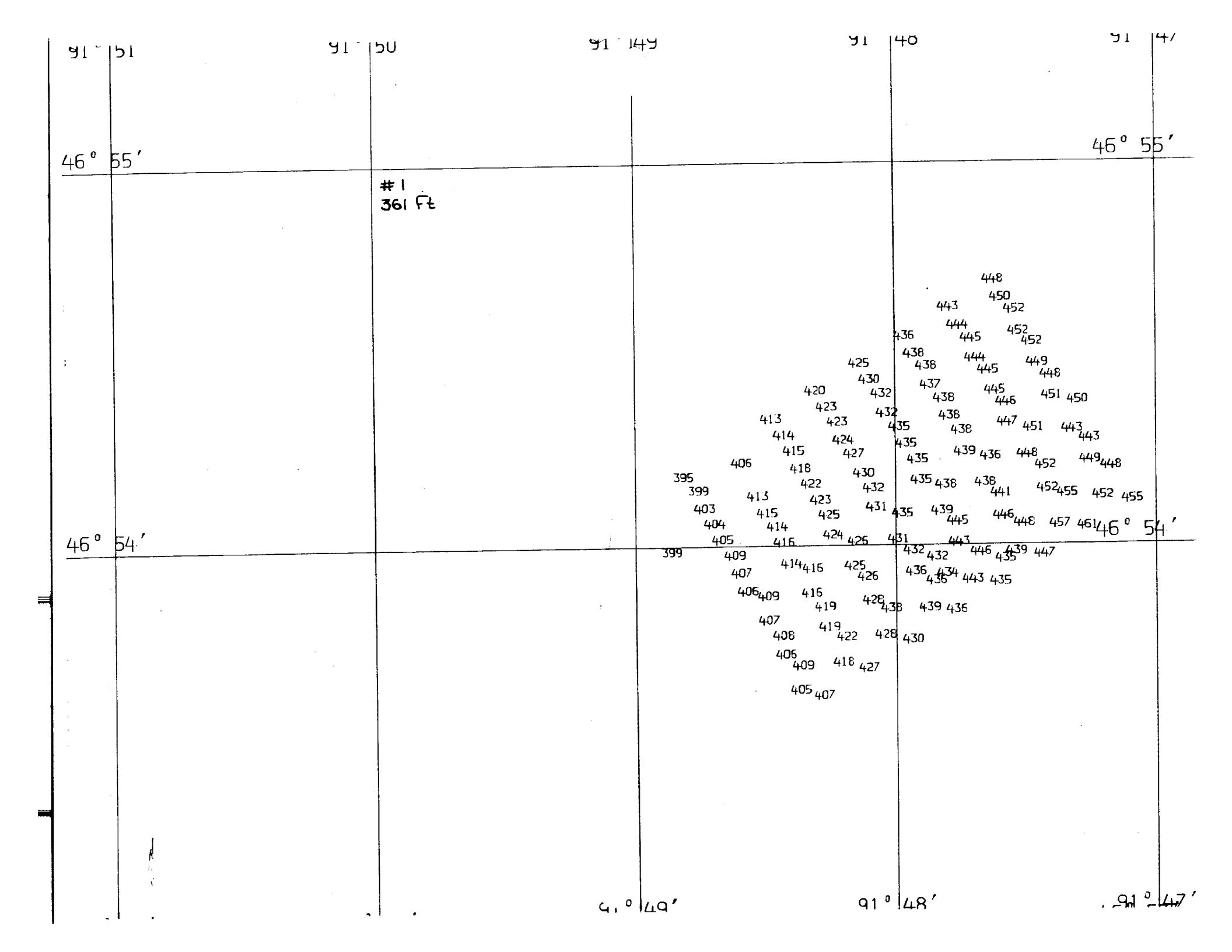
Inspected

R. D. Sanocki
Chief, Hydrographic Surveys
Processing Section
Hydrographic Surveys Branch

David B. MacFarland, Jr., LCDR, NOAA
Chief, Hydrographic Surveys Branch

Approved September 28, 1984

Wesley V. Hull, RADM, NOAA For
Director, Atlantic Marine Center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91° 47
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46° 54′
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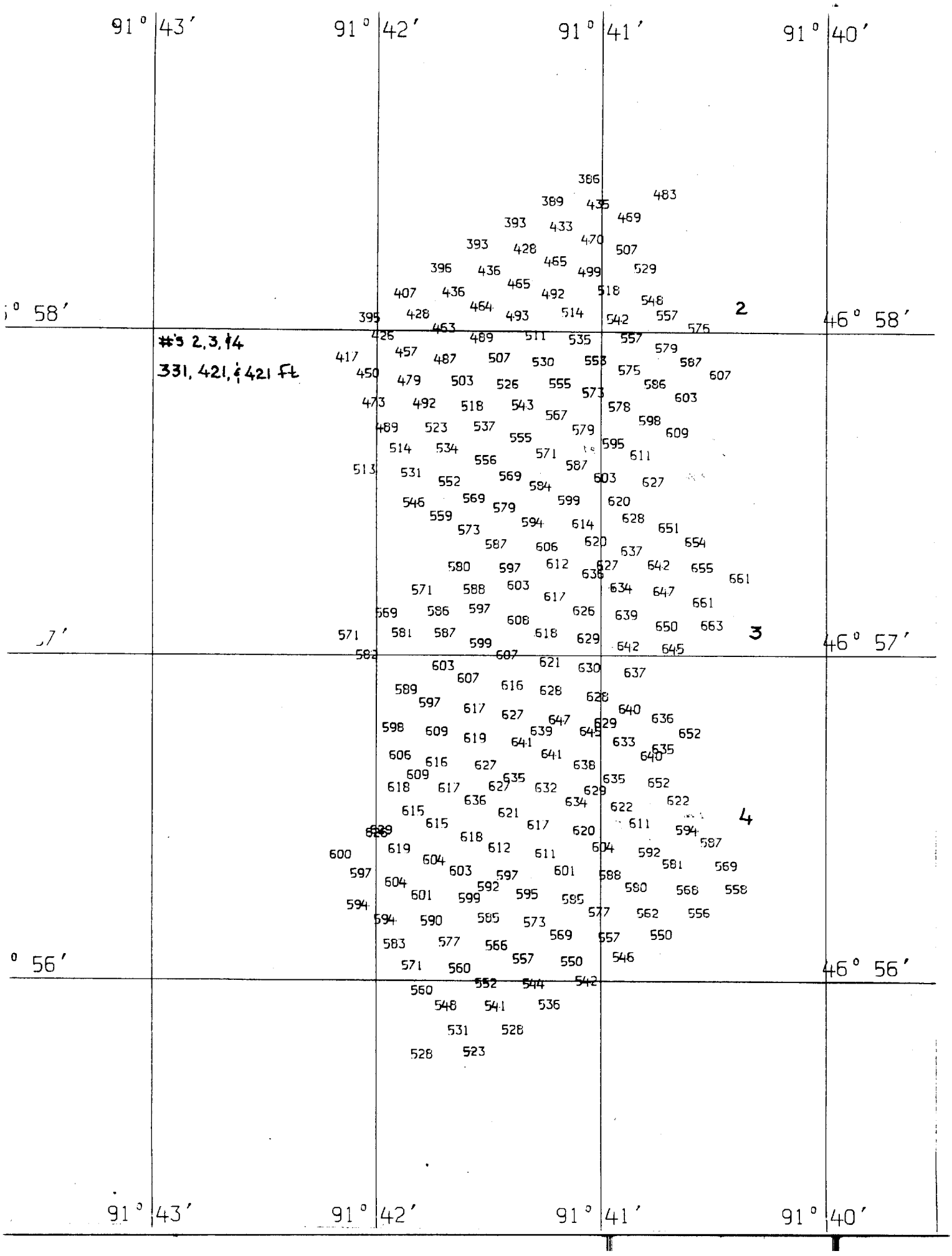
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91° 41′
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58′
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57′
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56′
46° 56′
#'s 2, 3, 4
331, 421, & 421 ft
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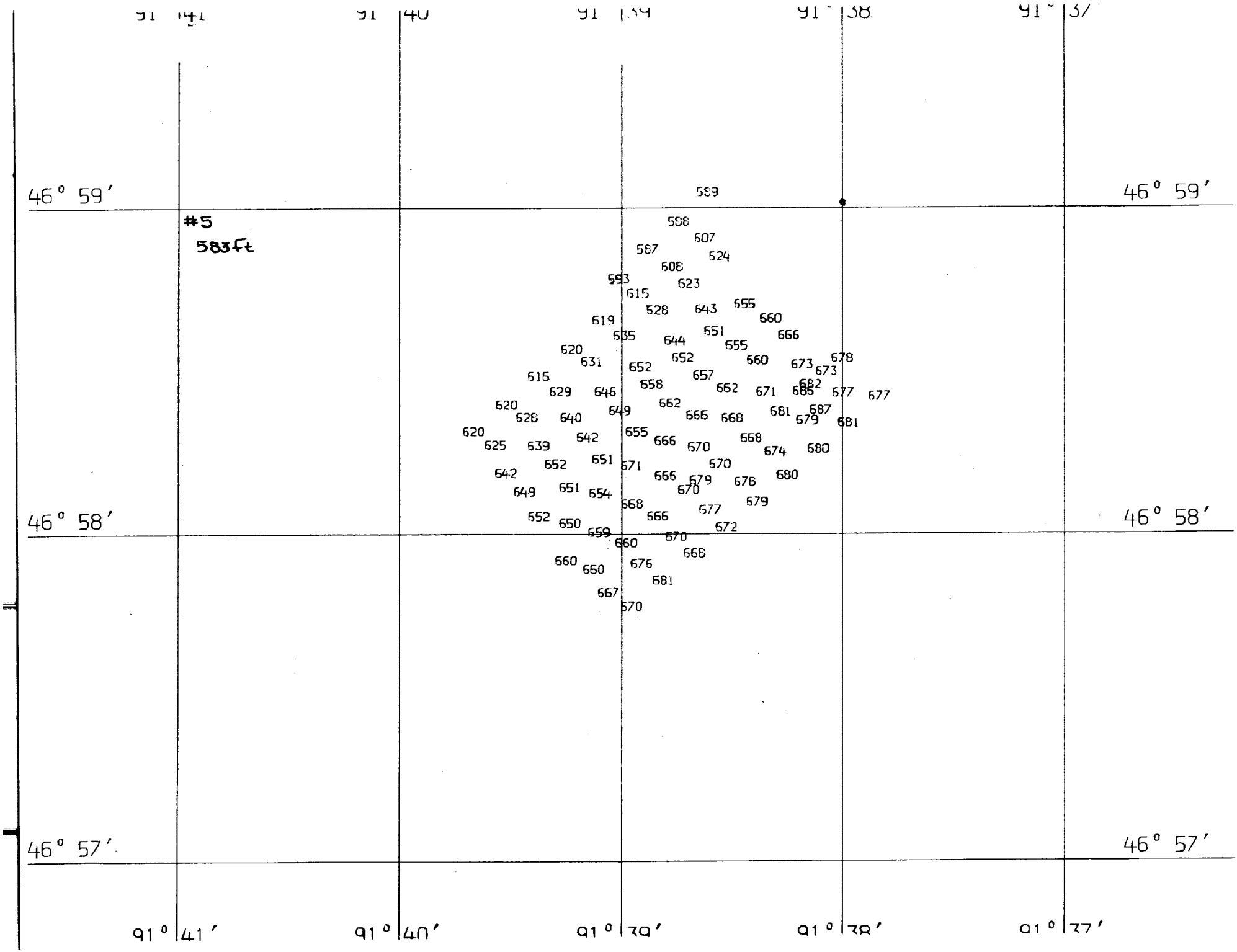
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91° 37′
46° 59′
46° 58′
46° 57′
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652
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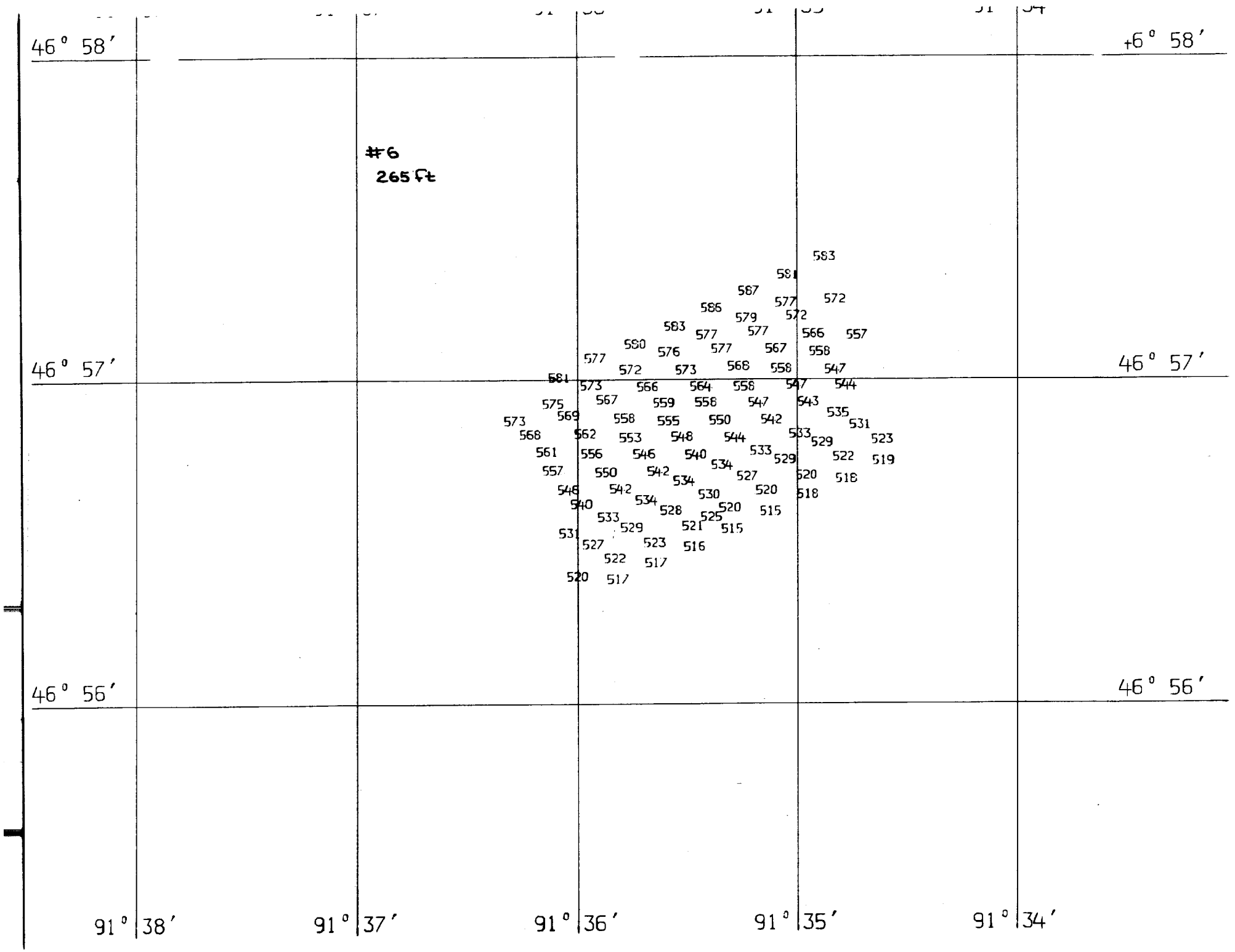
46° 58′
46° 57′
46° 56′
91° 38′
91° 37′
91° 36′
91° 35′
91° 34′
#6
265 Ft
583
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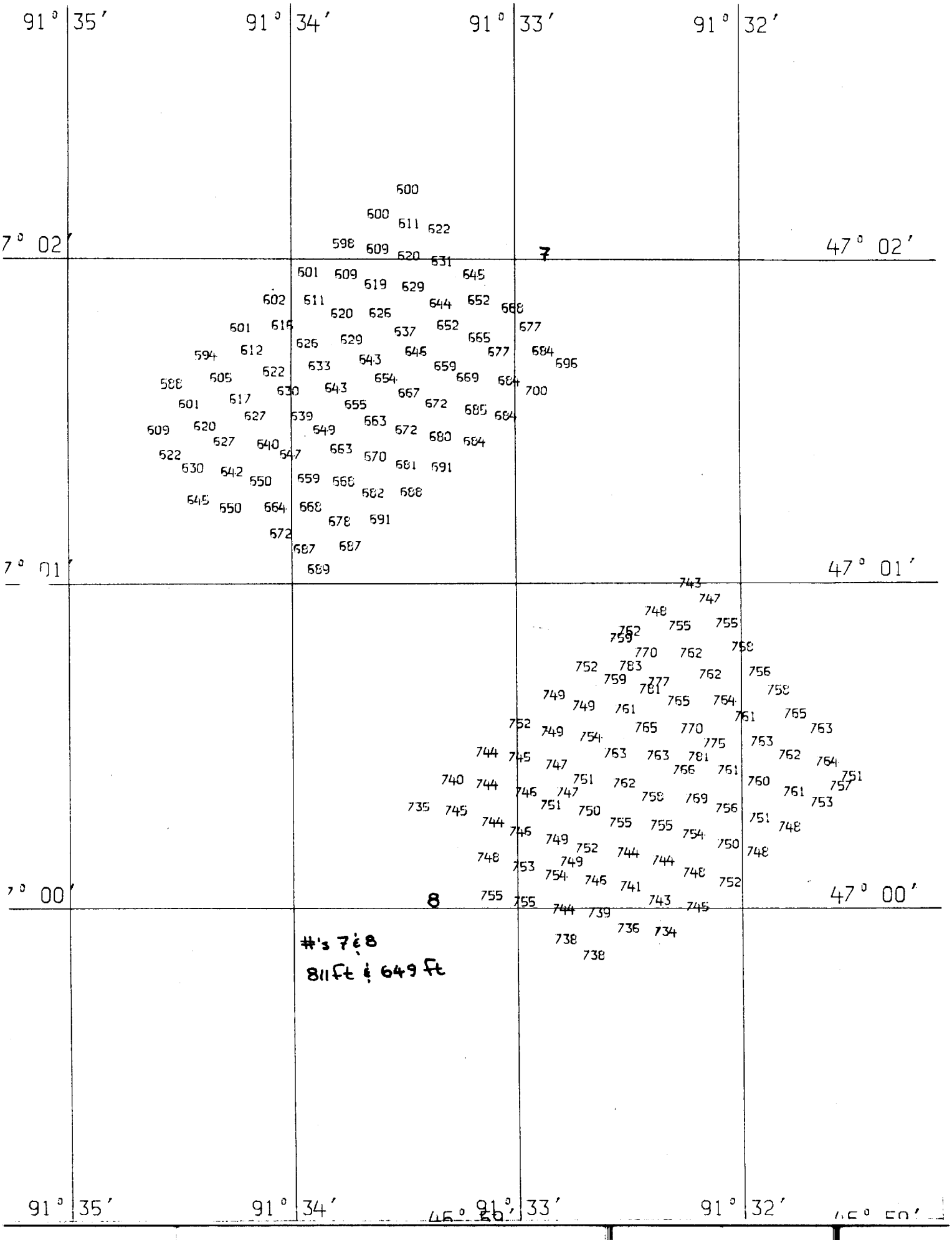
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91° 32′
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47° 01′
47° 00′
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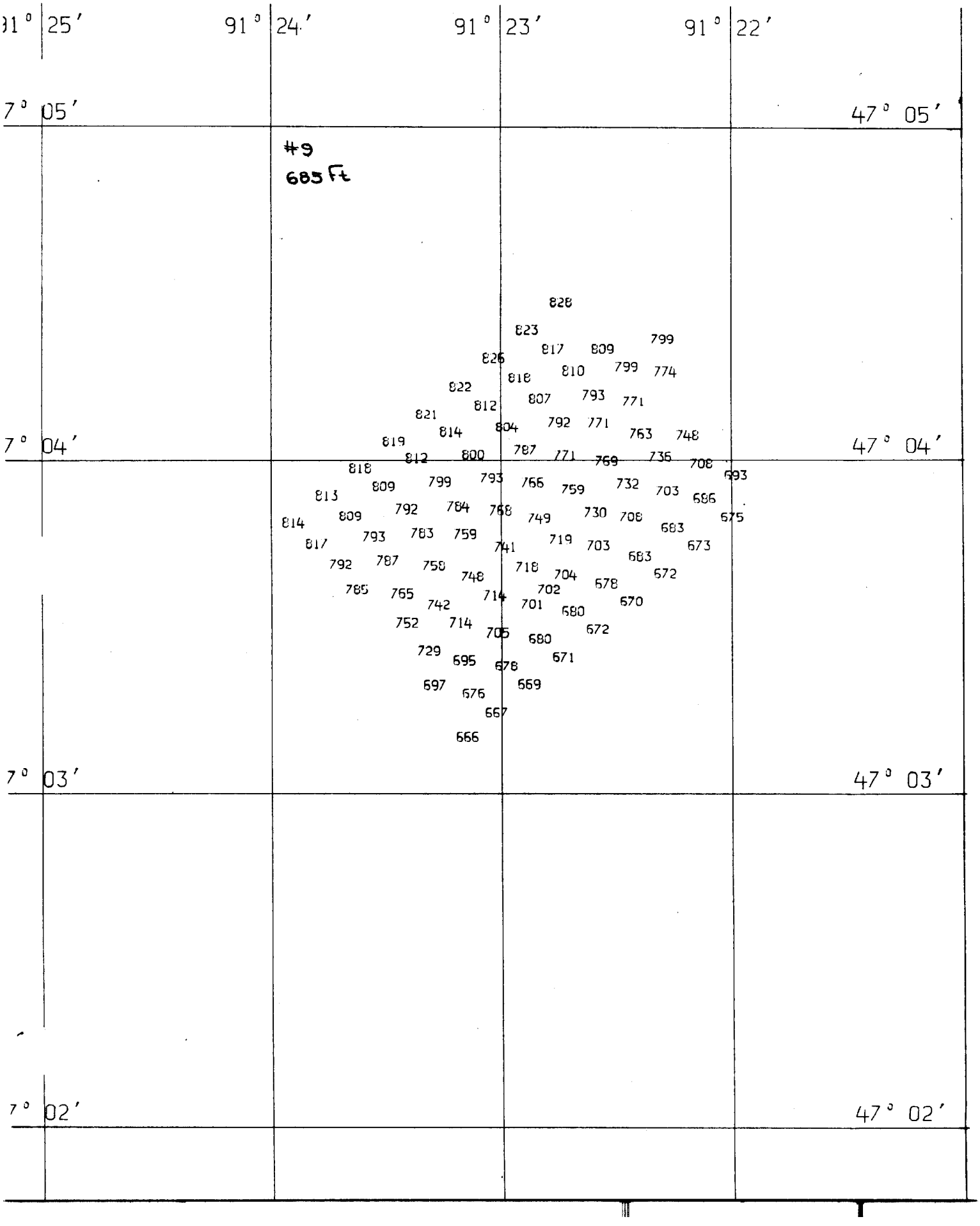
8
#'s 7 & 8
811 ft & 649 ft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47° 04′
47° 03′
47° 02′
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819 763 748
812 800 787 771 769 736 708
818 809 799 793 766 759 732 703 693
813 792 784 768 749 730 708 686
814 809 683 675
817 793 783 759 741 719 703 673
792 787 758 718 704 683
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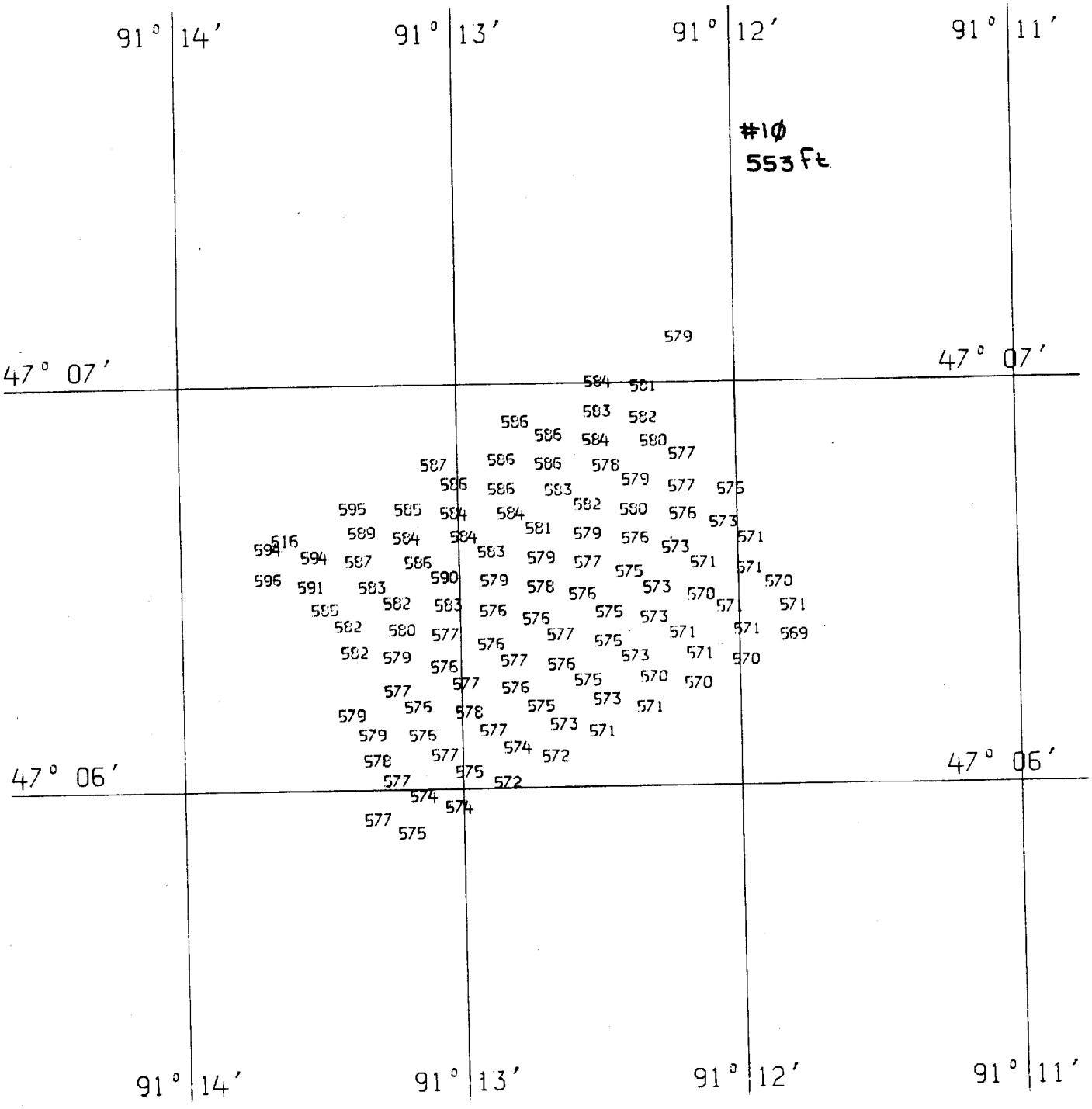
91° 14′
91° 13′
91° 12′
91° 11′
#10
553 Ft
47° 07′
47° 06′
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583 582
586 586 584 580 577
587 586 586 578 579 577 575
586 586 583 582 580 576 573
595 585 584 584 581 579 576 573 571
589 584 584 583 579 577 575 571 571 570
594 516 594 587 586 590 579 578 576 573 570 571 571
596 591 583 582 583 576 576 575 573 571 571 569
585 582 580 577 576 577 575 573 571 570
582 579 576 577 576 575 573 570 570
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579 576 578 575 573 571
579 575 577 574 572
578 577 575 572
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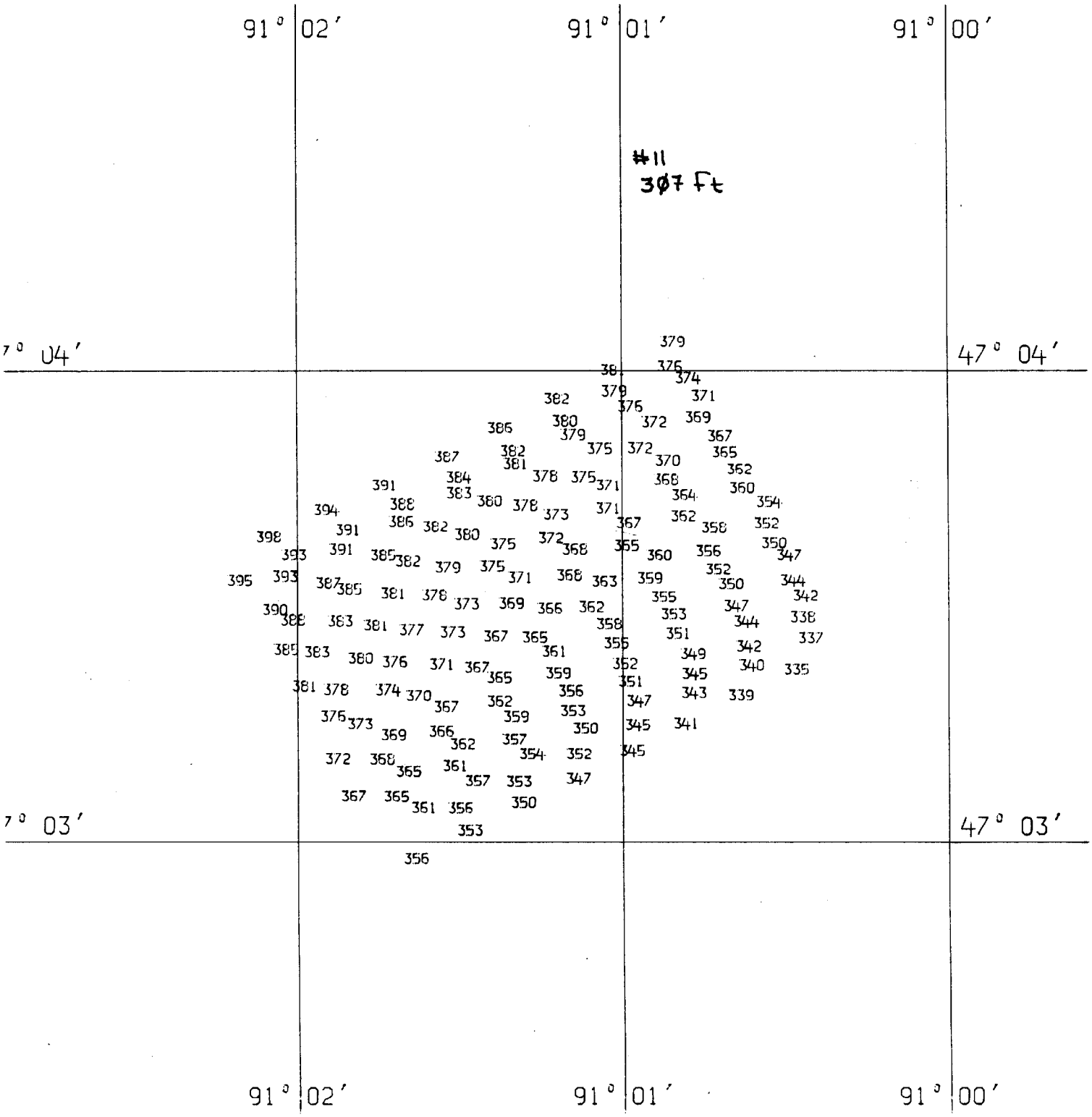
577 575
91° 14′
91° 13′
91° 12′
91° 11′

5-09-84


91° 02′
91° 01′
91° 00′
#11
307 Ft
47° 04′
47° 03′
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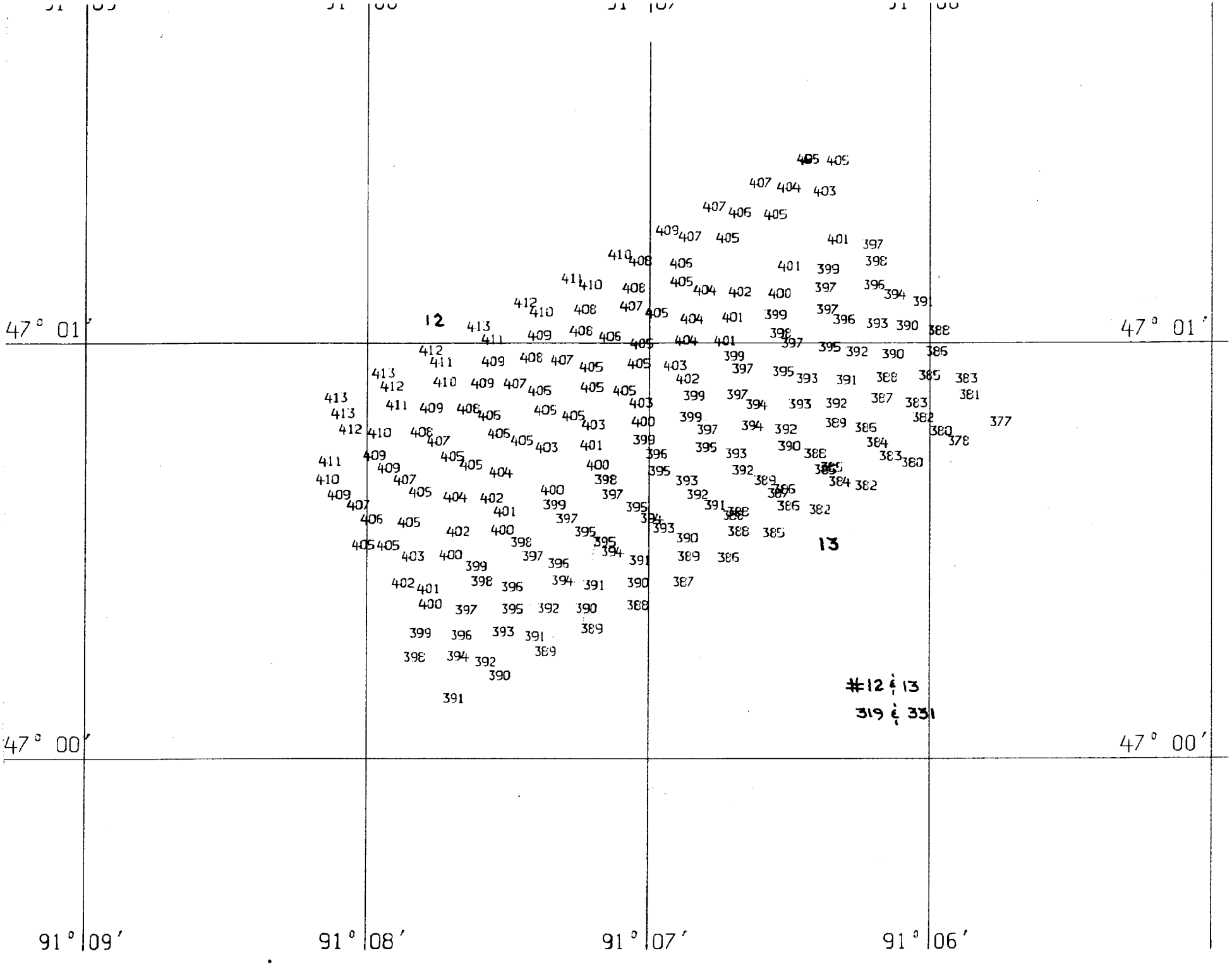
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47° 00′
91° 09′
91° 08′
91° 07′
91° 06′
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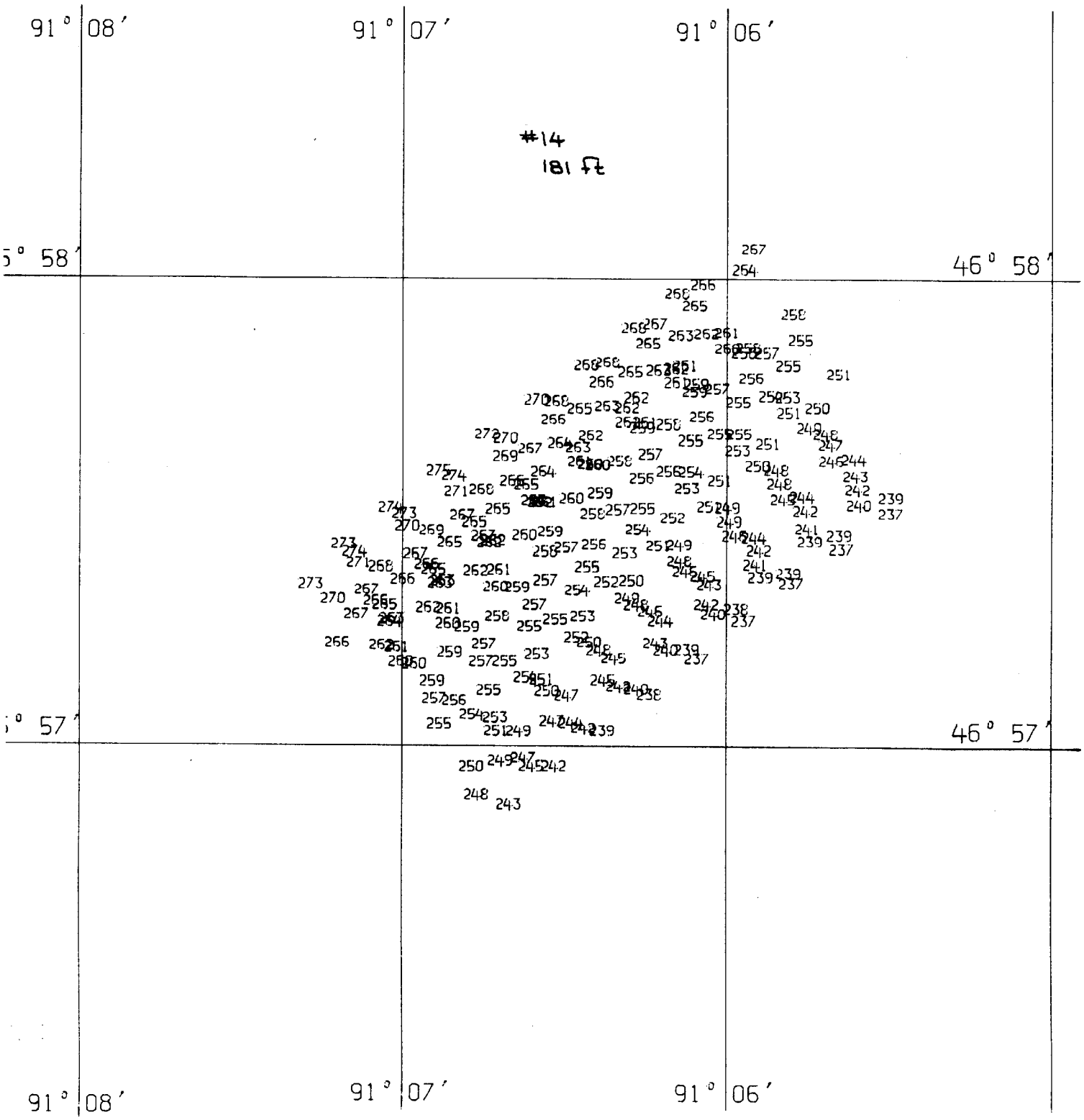
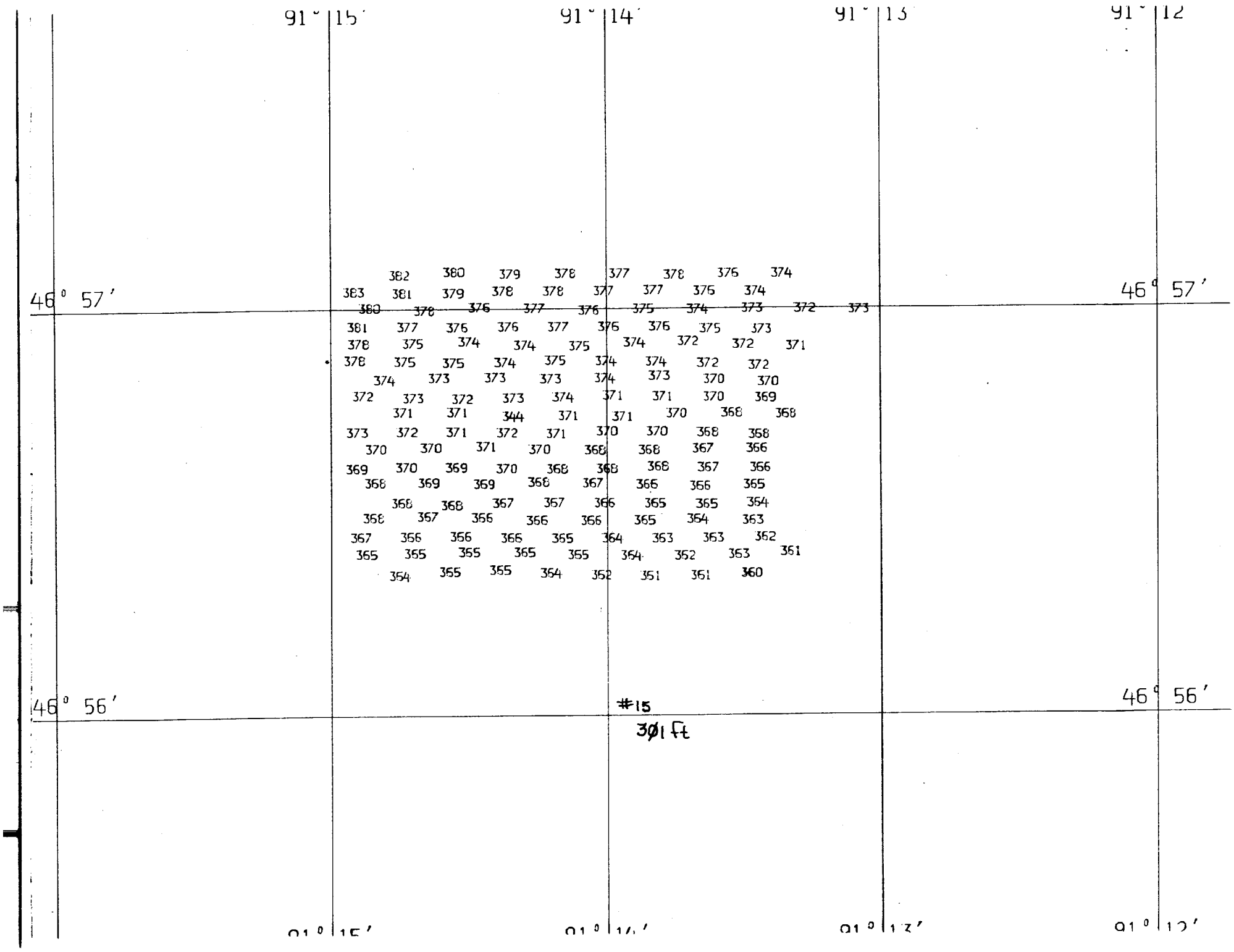
#12 & 13
319 & 331


91° 08′
91° 07′
91° 06′
#14
181 ft
5° 58′
46° 58′
5° 57′
46° 57′
91° 08′
91° 07′
91° 06′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91° 14'
91° 13'
91° 12'
46° 57'
46° 56'
382 380 379 378 377 378 376 374
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370 370 371 370 368 368 367 366
369 370 369 370 368 368 368 367 366
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365 355 355 365 355 364 352 363 361
354 355 355 354 352 351 361 360
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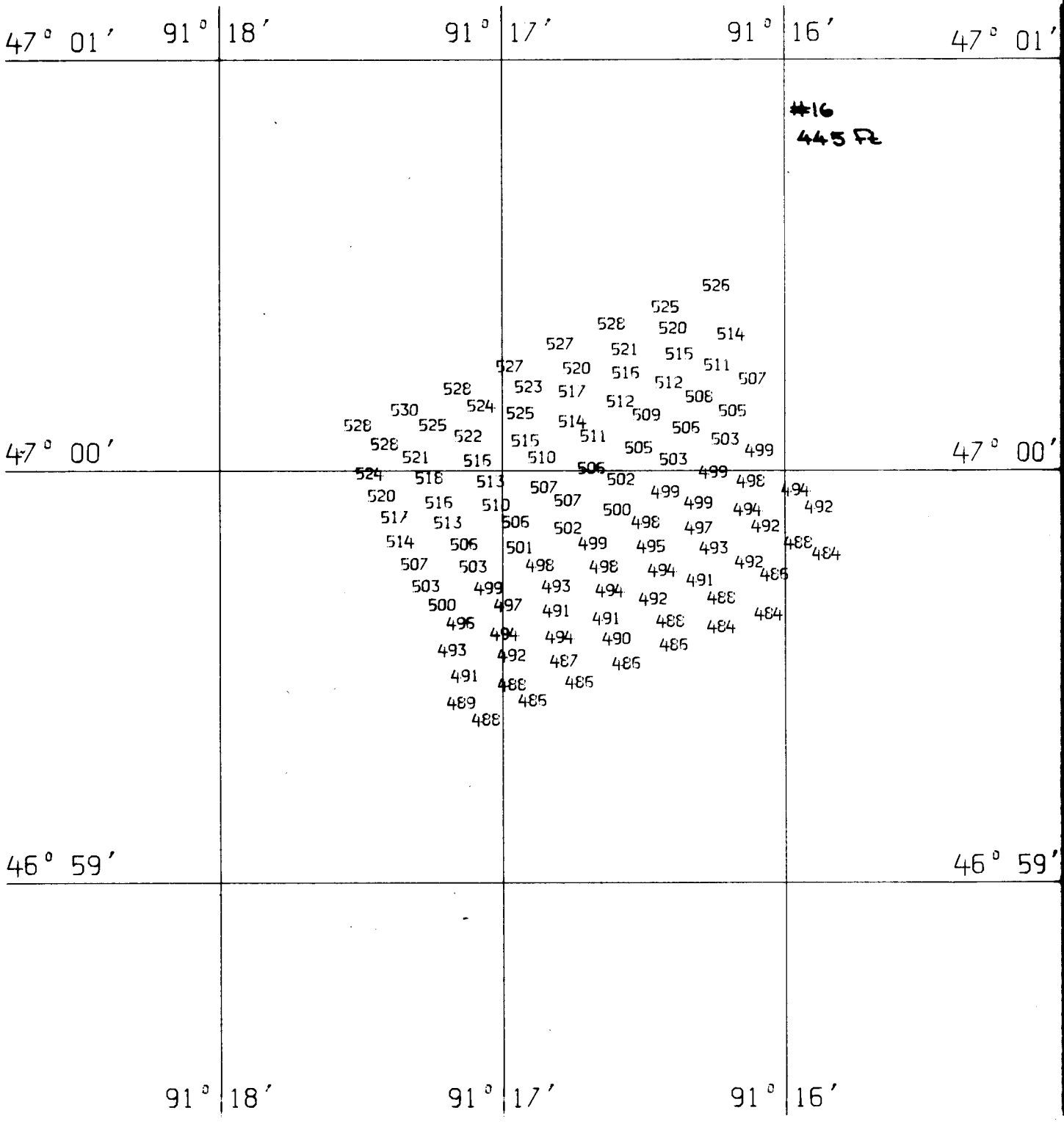
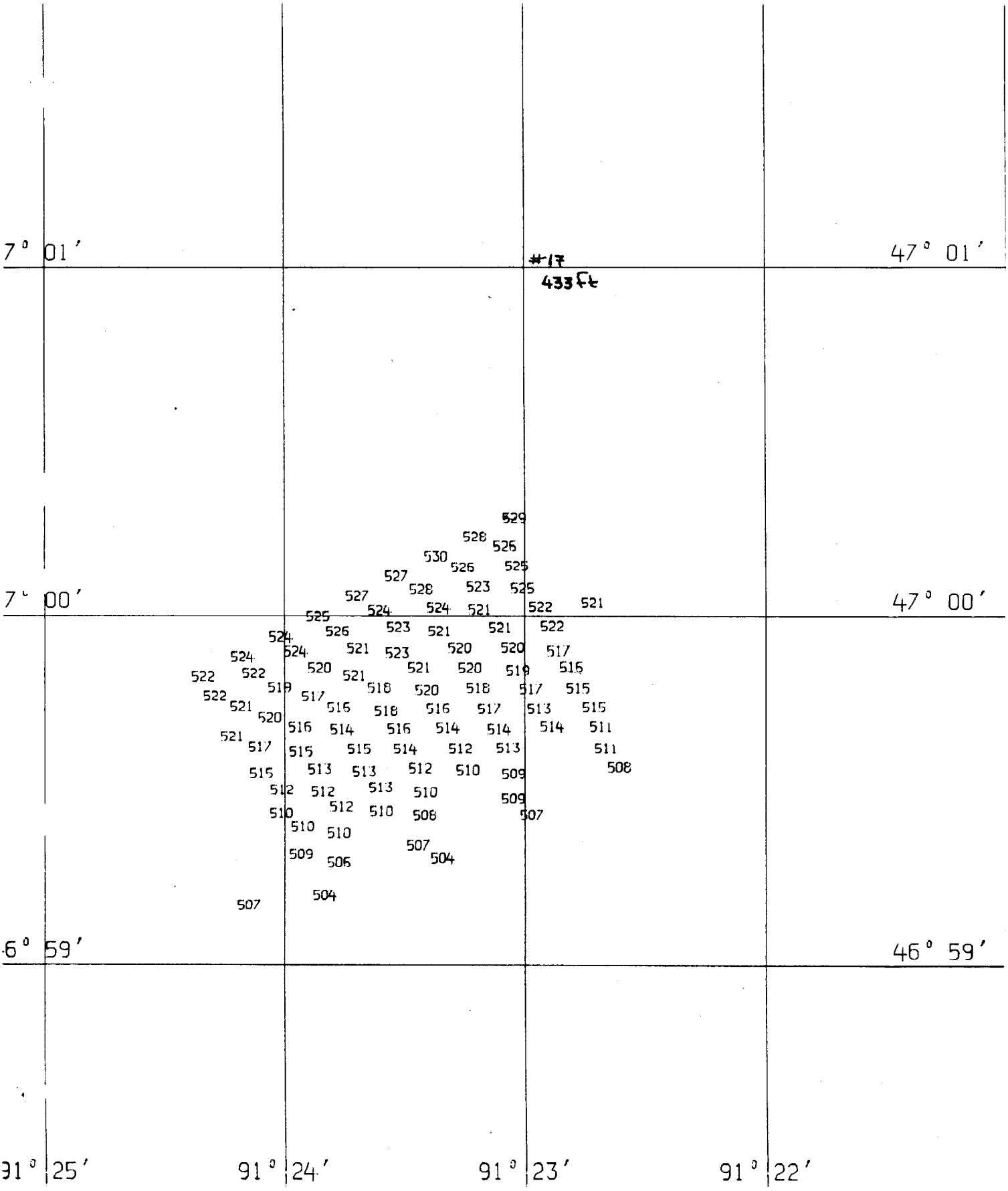
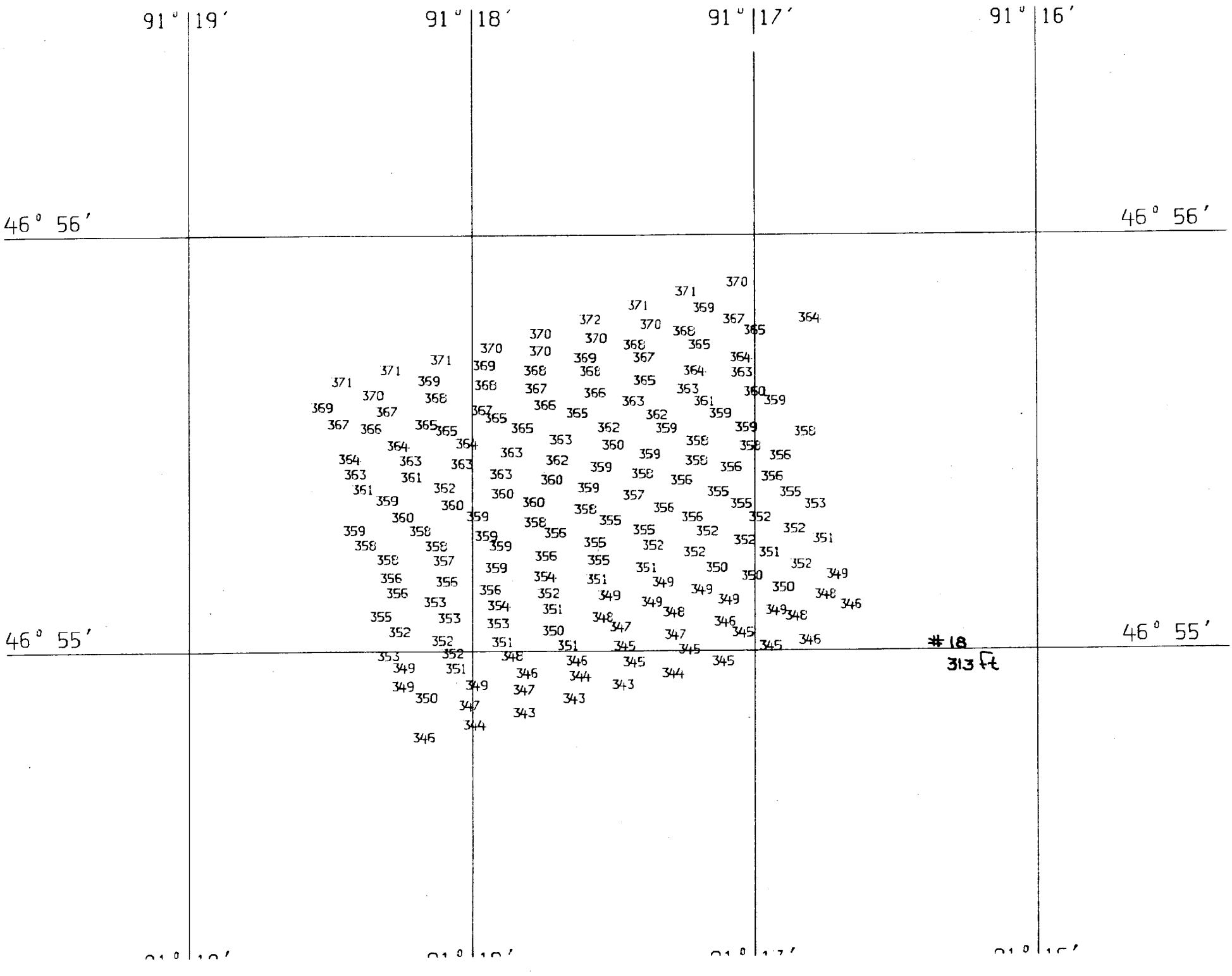
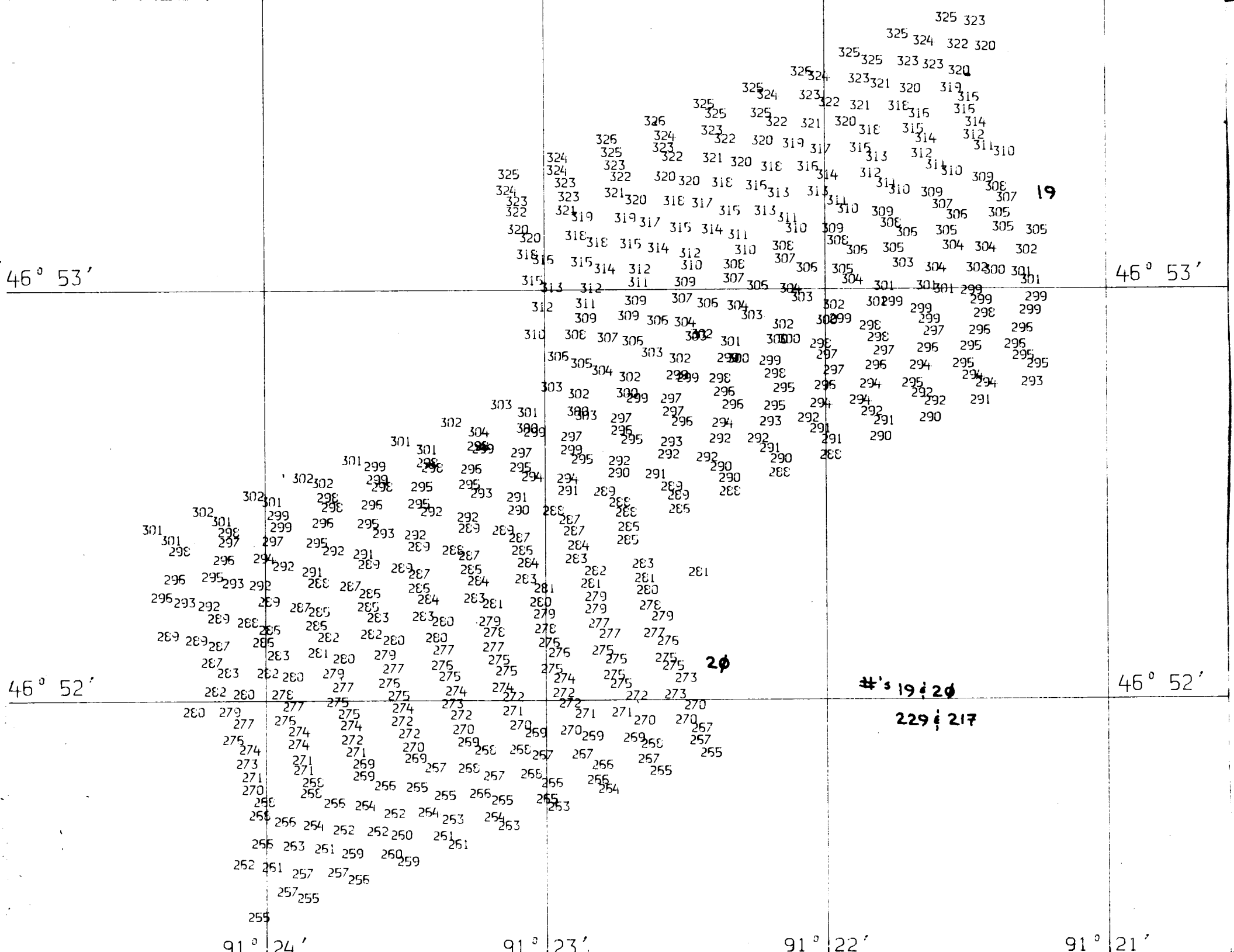
301 ft


47° 01′
91° 18′
91° 17′
91° 16′
47° 01′
#16
445 Ft
47° 00′
47° 00′
46° 59′
46° 59′
91° 18′
91° 17′
91° 16′

SPL 05-09-84


7° 01′
#17
433 Ft
47° 01′
7° 00′
47° 00′
6° 59′
46° 59′
91° 25′
91° 24′
91° 23′
91° 22′


91° 19′
91° 18′
91° 17′
91° 16′
46° 56′
46° 55′
#18
313 ft


46° 53′
46° 52′
91° 24′
91° 23′
91° 22′
91° 21′
19
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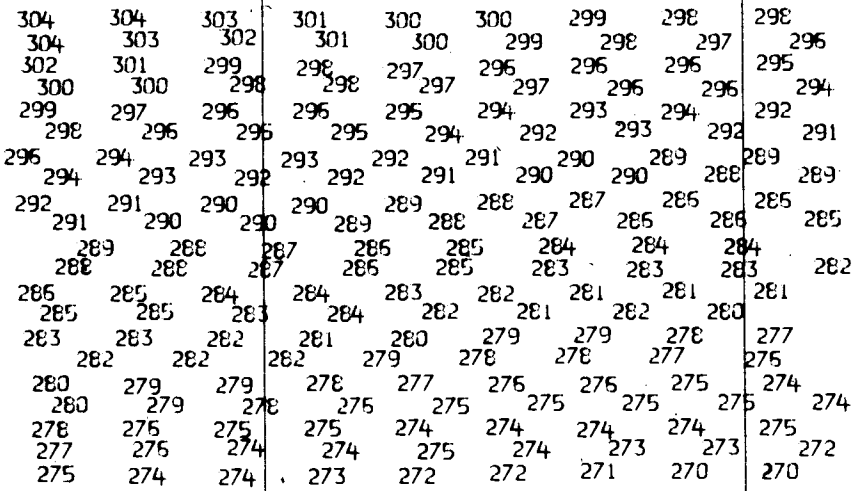
#'s 19 & 2ϕ
229 & 217

91° 30′ 91° 29′ 91° 28′ 91° 27′

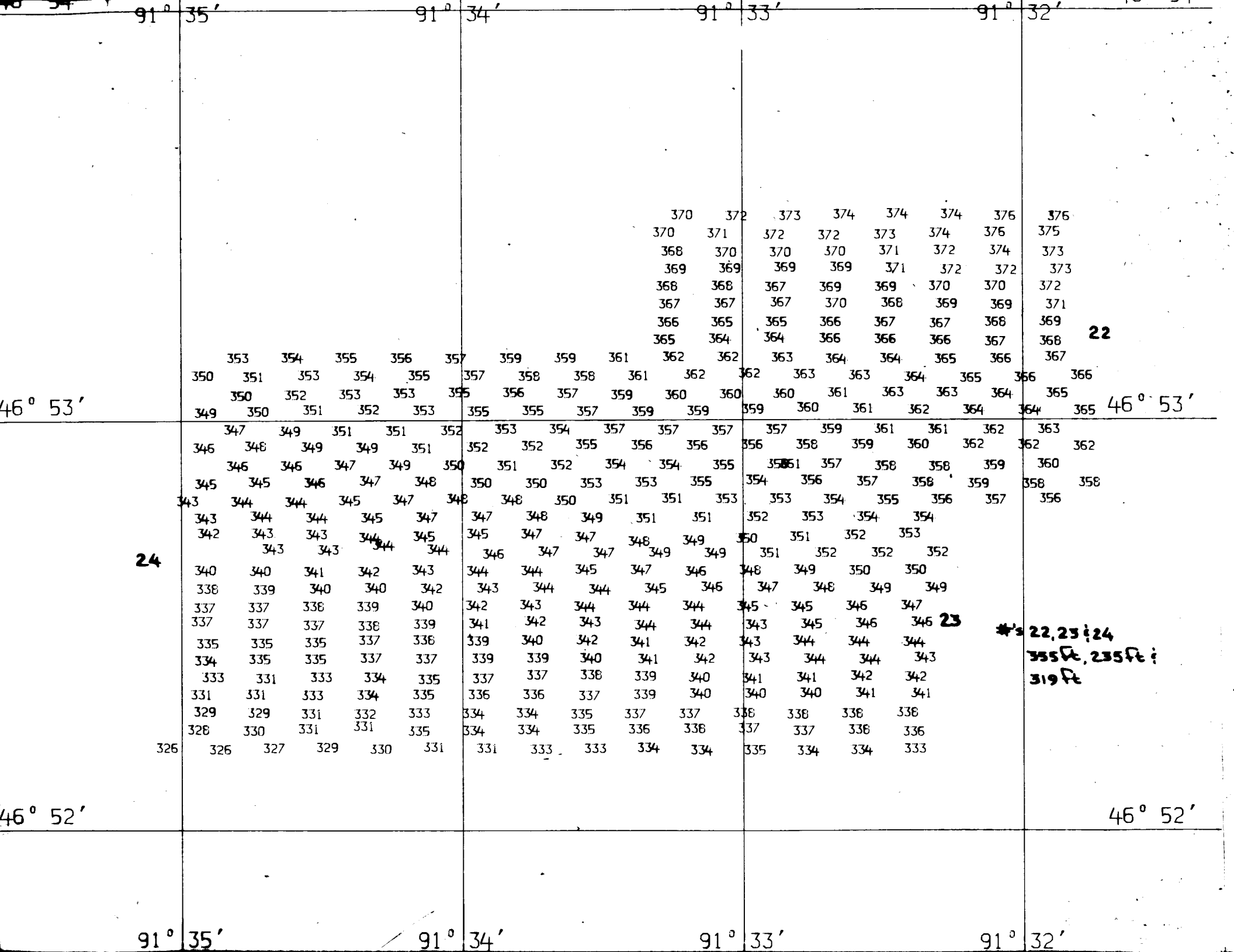
46° 52′ 46° 52′



46° 51′ 46° 51′

#21
217 ft

91° 30′ 91° 29′ 91° 28′ 91° 27′


91° 35′
91° 34′
91° 33′
91° 32′
46° 53′
46° 52′
22
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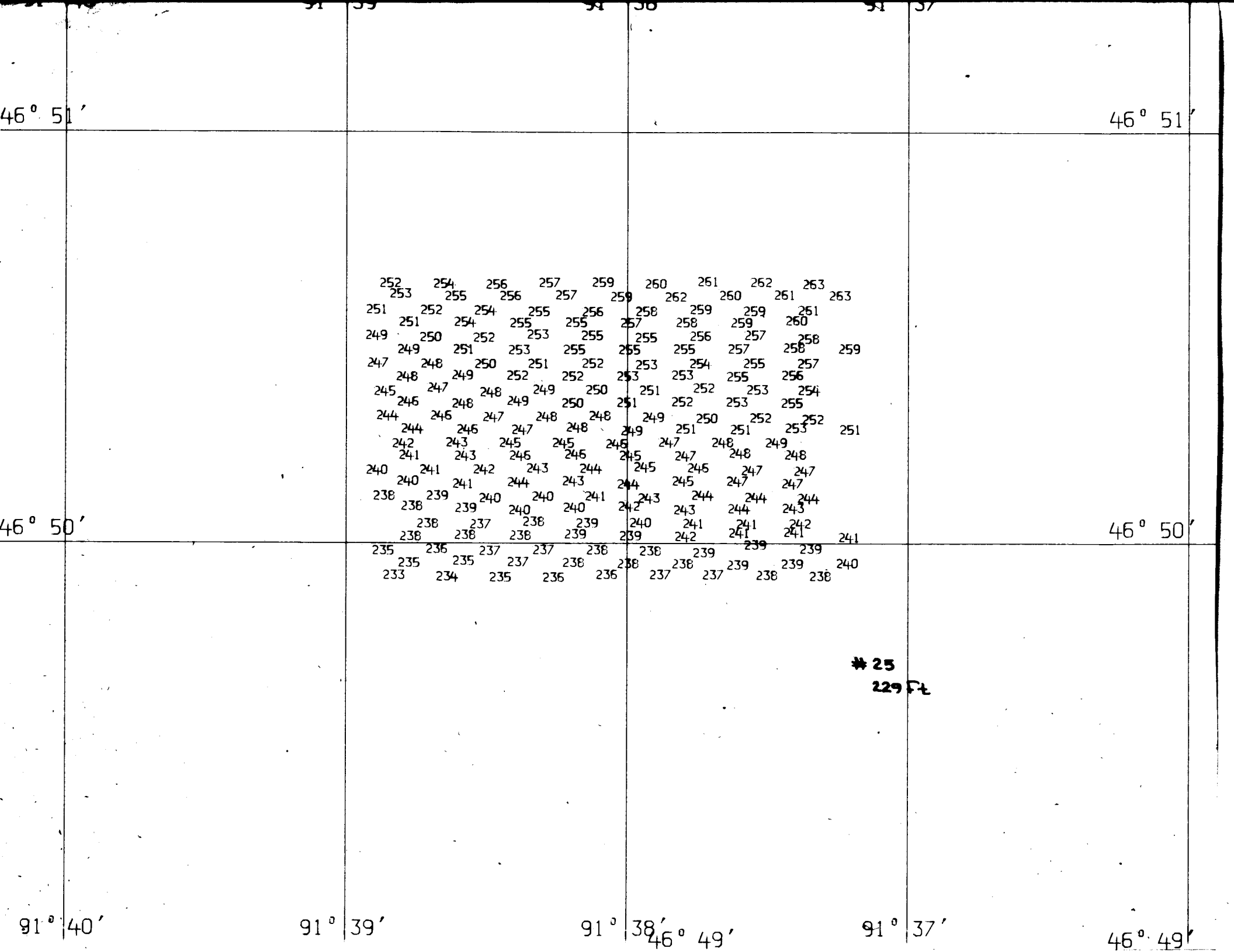
24
#'s 22, 23 & 24
355 ft, 235 ft &
319 ft


46° 51′
46° 51′
46° 50′
46° 50′
91° 40′
91° 39′
91° 38′
46° 49′
91° 37′
46° 49′
25
229 Ft

NOAA FORM 61-29 (12-71)

U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

LETTER TRANSMITTING DATA

REFERENCE NO.
MOA23-15-85

DATA AS LISTED BELOW WERE FORWARDED TO YOU BY (Check):

☐ ORDINARY MAIL ☐ AIR MAIL
☒ REGISTERED MAIL ☐ EXPRESS
☐ GBL (Give number) _____

TO:

CHIEF, DATA CONTROL SECTION
HYDROGRAPHIC SURVEYS BRANCH, N/CG243
NATIONAL OCEAN SERVICE, NOAA
ROCKVILLE, MD 20852

DATE FORWARDED
2/19/85

NUMBER OF PACKAGES
3 boxes; 1 tube

NOTE: A separate transmittal letter is to be used for each type of data, as tidal data, seismology, geomagnetism, etc. State the number of packages and include an executed copy of the transmittal letter in each package. In addition the original and one copy of the letter should be sent under separate cover. The copy will be returned as a receipt. This form should not be used for correspondence or transmitting accounting documents.

H-10036, OPR-Z137-PE-82, Field No. PE 50-1-82, Minnesota--Wisconsin, Lake Superior Offshore Sand Island to Gooseberry Reef

Pkg 1 of 4 (tube)
One smooth sheet
One smooth position overlay
Two smooth excess overlays
One original Descriptive Report
Three final field sheets
Three final field sheet overlays
Twelve preliminary field sheets

Pkg 2 of 4 (box)
One accordian file with echograms for:
Vessel No. 2830-days 214, 224, 225, 228-238, 266
Vessel No. 2837-day 231
Vessel No. 2839-day 232
One cahier with: final sounding printout; L-file (Z-record) printout

Pkg 3 of 4 (box)
One accordian file with field data printouts for:
Vessel No. 2830-days 214, 224, 225, 228-238, 266, 285-288
Vessel No. 2837-day 231
Vessel No. 2839-day 232
Four sounding volumes

FROM: (Signature)
for
D. B. MACFARLAND, JR., LCDR, CHIEF, HYDRO SURVEYS BR

RECEIVED THE ABOVE
(Name, Division, Date)
Dwayne S. Clark
March 11, 1985
N/CG243

Return receipted copy to:

HYDROGRAPHIC SURVEYS BRANCH, N/MOA232
ATLANTIC MARINE CENTER
NOAA — NATIONAL OCEAN SERVICE
439 WEST YORK STREET
NORFOLK, VA 23510
ATTN: THERESA HIGH

NOAA FORM 61-29 (12-71)

U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

LETTER TRANSMITTING DATA

REFERENCE NO.
MOA23-15-85

DATA AS LISTED BELOW WERE FORWARDED TO YOU BY *(Check)*:

☐ ORDINARY MAIL ☐ AIR MAIL
☒ REGISTERED MAIL ☐ EXPRESS
☐ GBL *(Give number)* _____

TO:

CHIEF, DATA CONTROL SECTION
HYDROGRAPHIC SURVEYS BRANCH, N/CG243
NATIONAL OCEAN SERVICE, NOAA
ROCKVILLE, MD 20852

DATE FORWARDED
2/19/85

NUMBER OF PACKAGES
3 boxes; one tube

NOTE: A separate transmittal letter is to be used for each type of data, as tidal data, seismology, geomagnetism, etc. State the number of packages and include an executed copy of the transmittal letter in each package. In addition the original and one copy of the letter should be sent under separate cover. The copy will be returned as a receipt. This form should not be used for correspondence or transmitting accounting documents.

-10036, OPR-Z137-PE-82, Field No. PE 50-1-82, Minnesota--Wisconsin, Lake Superior Offshore Sand Island to Gooseberry Reef

Pkg 3 of 4 (box) con't
Two notebooks (position calibration records)
One envelope with data removed from Descriptive Report
One notebook of supplemental data
One envelope with miscellaneous printouts
One cahier with: final control printout; final position printout
Pkg 4 of 4 (box)
Eight large envelopes with echograms for:
Vessel No. 2830-days 266, 285-288
Seventeen envelopes with sawtooth position charts

FROM: *(Signature)*
for Robert L. Ro
D. B. MACFARLAND, JR., LCDR, CHIEF, HYDRO SURVEYS BR

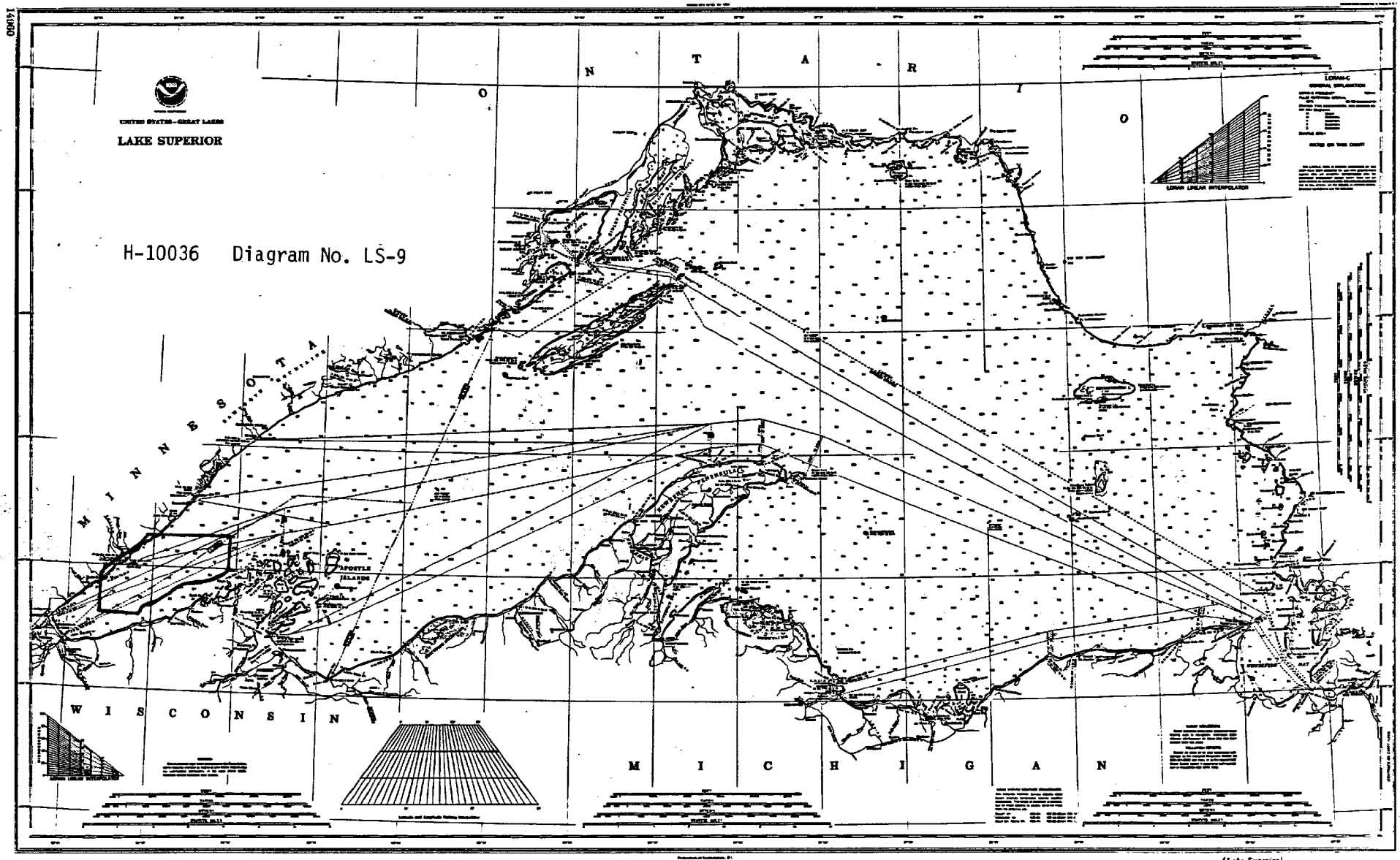
RECEIVED THE ABOVE
(Name, Division, Date)
Dwayne S. Clark
March 11, 1985
NICG243

Return receipted copy to:

HYDROGRAPHIC SURVEYS BRANCH, N/MOA232
ATLANTIC MARINE CENTER
NOAA — NATIONAL OCEAN SERVICE
439 WEST YORK STREET
NORFOLK, VA 23510

ATTN: THERESA HIGH

NOAA FORM 61-29 SUPERSEDES FORM C&GS 413 WHICH MAY BE USED. ☆U.S. GOVERNMENT PRINTING OFFICE: 1980—765-012/1121


LAKE SUPERIOR
H-10036 Diagram No. LS-9
ONTARIO
MINNESOTA
WISCONSIN
MICHIGAN

NOAA FORM 75-96
(10-83)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

MARINE CHART BRANCH

RECORD OF APPLICATION TO CHARTS

FILE WITH DESCRIPTIVE REPORT OF SURVEY NO. H-10036

INSTRUCTIONS

A basic hydrographic or topographic survey supersedes all information of like nature on the uncorrected chart.

1. Letter all information.
2. In "Remarks" column cross out words that do not apply.
3. Give reasons for deviations, if any, from recommendations made under "Comparison with Charts" in the Review.

CHART	DATE	CARTOGRAPHER	REMARKS
14973	11-26-85	[illegible]	Full ~~Part Before~~ After Marine Center Approval Signed Via [illegible] 12-3-85
			Drawing No. 3 Appd in full
14966	11-27-85	Russell P Kennedy	Full ~~Part Before~~ After Marine Center Approval Signed Via
			Drawing No. 4 Appd in full. Added (2) sndgs on Two Hbrs Inset.
14960	8-19-87	J Pinone	(Full) Part Before (After) Marine Center Approval Signed Via
			Drawing No. 5 Applied in full from 14966-14973
14961	8-19-87	J Pinone	(Full) Part Before (After) Marine Center Approval Signed Via
			Drawing No. 5 Applied in full from 14966-14973
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
	3-12-85	Appd To Stds Mar	

SUPERSEDES C&GS FORM 8352 WHICH MAY BE USED.